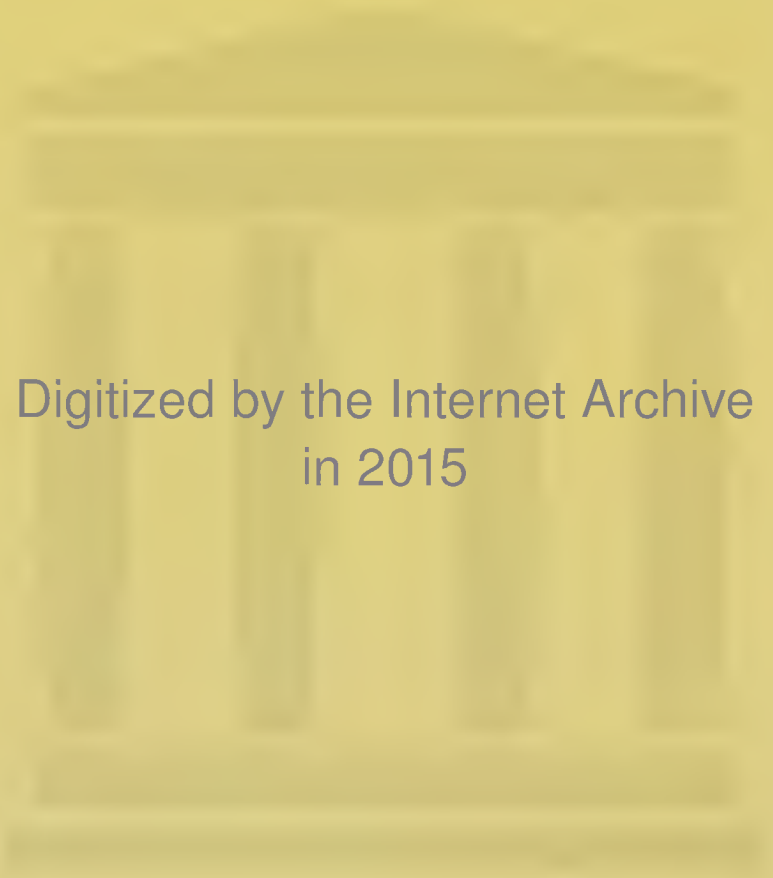
6 OCT 1997	6 NOV 19[illegible]	
		GUL 68.18



AN

INTRODUCTION

TO THE

USE OF THE STETHOSCOPE;

WITH

ITS APPLICATION TO THE DIAGNOSIS IN DISEASES OF THE THORACIC VISCERA;

INCLUDING

THE PATHOLOGY OF THESE VARIOUS AFFECTIONS.

By WILLIAM STOKES, M.D.

EDINBURGH:

PRINTED FOR MACLACHLAN AND STEWART;
BALDWIN, CRADOCK, AND JOY, LONDON;
AND HODGES AND M'ARTHUR,
DUBLIN.

M.DCCC.XXV.

PRINTED BY A. BALFOUR AND CO.

TO

WILLIAM CULLEN, M. D.

LECTURER ON ANATOMY AND PHYSIOLOGY IN EDINBURGH,

&c. &c. &c.

WHOSE UNREMITTING ATTENTION TO THE LIGHT WHICH MEDIATE AUSCULTATION IS NOW THROWING ON THE OBSCURITY OF DISEASE, AND WHOSE ARDENT PURSUIT OF MEDICAL SCIENCE, THROUGH ITS OTHER VARIOUS BRANCHES, CLAIM THIS MARK OF UNFEIGNED RESPECT,

THE FOLLOWING PAGES ARE DEDICATED,

BY HIS SINCERE FRIEND,

WILLIAM STOKES.

PREFACE.

The following production, I am aware, may be thought superfluous by some, especially by those who have paid much attention to the important class of diseases of which it treats; who are intimately acquainted with the great works of Bayle, Lænnec, and Andral; whose pathological knowledge needs not the assistance of such a compendium; and who, long familiar with the use of that most important and necessary instrument, the stethoscope, have gained an intimate knowledge of the signs which it discovers, and the particular diseases of which these signs are indicative. But this work is not intended either to en-

lighten or assist such eminent individuals; it has an humbler though not less important aim; it is destined to be the assistant of the student, whether as a tyro, first commencing his medical labours, or as one more advanced in the Apollonian art, who may wish to become acquainted with the new methods of diagnosis, in diseases of the thoracic cavity.

By others it may be said, that the student is already in possession not only of a translation of M. Lænnec's work by Dr. Forbes, but also of a work on the application of the stethoscope, by the same distinguished physician; and, therefore, that the present attempt is uncalled for. But I hope that a slight review of the plan which I have pursued, will at least soften their unfavourable conclusion. It appears to me, that neither in the works of Lænnec nor of Forbes, have the accounts of the different signs obtained by the stethoscope, been properly connected with that of the pathological state of the viscera, to which they owe their origin. I have, therefore, after describing each phenomenon, endea-

voured to give a succinct account of the morbid condition producing it; so that the student, upon perceiving any deviation from the natural state, may, when he compares it with the description of the phenomenon which it most resembles, be at once led to that of the alteration which is to be expected.

I have divided the phenomena obtained by examining the respiration, voice, and action of the heart, into the heads of natural and pathological. Under the pathological phenomena of respiration, I have given an account of the different *rales*, and following each, the pathological state of the part producing it; thus, under the head of the *crepitating rale*, is given the pathology of pneumonia, œdema of the lung, and pulmonary apoplexy. Under the sonorous rale, that of bronchitis, (enriched by the observations of M. Andral.) Under the hissing rale, emphysema. When we come to the pathological phenomena of the voice, we have phthisis under pectoriloquism; pleurisy under egophonia; and pneumo-thorax under the metallic tinkling.

It may appear that the pathology is thus too much divided, but as morbid appearances are so different from one another, their division is rather a desideratum than otherwise; especially when connected with the symptoms, as in the following pages.

My first intention was merely to have given a literal translation of M. Collin's work,* and to have inserted the pathology of each disease. But, upon further consideration, I abandoned this idea, not approving of the above author's arrangement. I have, therefore, taken from him only such parts as appeared absolutely necessary, and have added wherever I could do so with advantage, always, however, keeping brevity in view. To the last precaution I have been particularly attentive, so that, whatever be the imperfections of this work, it has, at least, the merit of being short, and therefore within the reach of every one. After describing each disease, I have inserted a case

* Des diverses methodes d'exploration de la Poitrine.

illustrative of the use of the stethoscope in the particular affection, and in the Appendix, an account of gangrene of the lung, illustrated by two cases, which occurred in the hospital of La Charité. I thought it better not to describe this disease in the account of pneumonia, as its nature is still "*sub judice.*" Following this article is an abridged translation of M. Andral's admirable thesis on expectoration. As this is a subject but little studied in these countries, I earnestly recommend a careful perusal of the above to all my readers; let them be assured, that with a knowledge of the stethoscope, and an acquaintance with the characters of expectoration, they can hardly err in their diagnosis of thoracic disease.

The pathology is taken chiefly from the works of Andral and Lænnec, to which last great name it is almost presumption to offer any thing like praise. His work will remain an everlasting monument of talent, industry, and perseverance. And when, at the close of his brilliant career, this illustrious individual looks back on his past la-

bours, he may in truth exclaim with the poet—

> " Non omnis moriar ; multaque pars mei
> " Vitabit libitinam."

I might here enter into a long dissertation on the utility of the stethoscope, but such is not my intention. It is a common objection to the use of this instrument, that it leads to no practical results, and therefore that it is more useful to the pathologist than to the physician. But those who make use of such an objection, only betray their ignorance of the use of the stethoscope, and, like unjust judges, pronounce sentence without examining into the merits of the case. The stethoscope, besides its vast importance in the diagnosis of a most difficult class of diseases, *does* lead to many useful *practical* results. Let us take the cases of pneumonia and of pleurisy, two of the most common and severe affections of the thoracic cavity; where a daily examination by means of the stethoscope, points out the progress of the disease, its exact seat, the effect of our remedies, the necessity of their repetition,

or the utility of their omission. In circumscribed pleurisy, in wounds of the thorax, its utility is undeniable. From ignorance of its application, displacement of the heart, arising from a pleuritic effusion, has been mistaken for dilatation of that organ, while the original disease was entirely overlooked. Pleurisy has been mistaken for rheumatism, and a critical diaphoresis has been checked in pneumonia. In confirmed phthisis, when the hopes of the sufferer's friends are excited by an ignorant practitioner, the physician, with the aid of the stethoscope, has at least the melancholy advantage of saving to those friends the pangs of disappointed hope, and to the patient himself the torture of useless remedies. By means of the stethoscope we can detect latent inflammatory affections of the pulmonary organs, long before they have become evident from their external symptoms. These are cases where a practitioner ignorant of mediate auscultation would be completely at a loss. I could adduce a host of other instances, but refrain from doing so, in the

firm conviction that such will not be required by any one who has used the stethoscope in ten cases of thoracic disease. Even without reference to actual disease, is it not a great practical advantage, that in doubtful cases we can explore the hidden recesses of the thorax, and say with confidence to our patient, There is no disease here?

In the history of mankind it will be found, that no great discovery, or probable conjecture was ever promulgated, without encountering the most bitter opposition. Harvey was thought a dreamer, yet he proved the circulation of the blood; and Columbus was laughed at as a projector, until he returned with the spoils of the west. But in this enlightened age, let us not judge with our eyes shut. Mediate auscultation, like truth, does not shrink from inquiry, but, on the contrary, courts investigation. Her advocates only demand a fair trial; they enter the lists with confidence, and bear for their motto the saying of the wise man, "That a new fact is a new friend; and when we

have gotten rid of an error, we have, in reality, conquered an enemy."

To conclude, if there are faults in this work, let the reader be assured, that neither time nor pains were spared to render them as few as possible. Its chief merit is the arrangement, which, as a high authority has observed, constitutes half the value of a book. With the hope that my labours may not prove wholly unacceptable to the medical world, I submit the following pages to public judgment, and only ask for them an impartial criticism.

INTRODUCTION

TO THE USE OF THE STETHOSCOPE.

In the study of medicine, when we wish to estimate the importance of any addition either to our knowledge, or the means of obtaining it, we must consider how far this addition of knowledge, or new method of arriving at it, tends to the improvement of science in general, and more particularly to the alleviation of disease. Facts which relate to diseases of rare occurrence are of less value, in a practical point of view, than those which have an intimate connexion with maladies, whose ravages sweep off a frightful proportion of mankind. Such are the different affections of the chest, which, in this point of view, are perhaps of more importance than those of any other cavity in the human body. Before the discovery of

Auscultation, the diagnosis of these affections was obscure and difficult;—many and fatal must have been the errors into which medical men fell in the absence of such a light. Percussion, it is true, was had recourse to, but only in latter times has this method been brought to the scanty perfection of which it is capable. Percussion alone is in many cases useless, but as, when combined with mediate auscultation, it becomes of the highest value, I will give a short account of it, before passing to the proper subject of this work.

OF PERCUSSION.

The sound heard upon striking the chest is always proportional to the size of this cavity, and the thickness and elasticity of its parietes. It varies according as we strike on a point covered with soft and thick parts; according to the state of emaciation or infiltration of the cellular substance; the posture of the patient; the part struck; and the manner of practising the percussion.

A clear sound, which has been compared to that produced by striking an empty barrel, is obtained anteriorly when we strike on the clavicles; on the space two or three inches below them; on the entire surface of the sternum; and the neighbouring parts of the costal cartilages.

Laterally, the axilla, and the space for three inches below it, are the places where the clearest sound is obtained; on the right side, from the

fourth rib, and sometimes even the third, to the inferior part of the chest, the sound becomes less clear on account of the vicinity of the liver; while on the left, it is often clearer from the proximity of the stomach, especially when this viscus is distended with air.

Posteriorly, by striking on the line of the costal angles, and in thin subjects on the spaces superior or inferior to the spine of the scapula; and also on the spine of the scapula itself, a clear and distinct sound is obtained; but we learn nothing from using percussion on the thick muscular bed which fills the vertebral grooves.

It is almost unnecessary to mention, that, *cæteris paribus*, the chest of an emaciated person will be more sonorous than that of an individual loaded with fat, or whose muscles are large and soft. In a patient labouring under infiltration of the cellular substance of the thoracic parietes, no conclusion can be drawn from percussion. It is necessary, in order to hear and judge of the sound from percussion, that the patient shall be placed sitting in his bed, and that the part which we wish to examine shall be stripped of all clothing. In examining the anterior part of the chest, the arms are to be held backwards; when it is the

posterior, they are to be crossed upon the chest, and the patient is to bend forwards. The object of these different positions is to stretch the muscles which cover the parietes of the thorax.

In order that percussion, apparently so simple an operation, shall lead to truly useful results, a great number of precautions are necessary. In the first place, the fingers are to be held in a state of demiflexion; their extremities should be in the same line; the operator is to strike with an equal and moderate force on similar parts and in the same manner, that is to say, letting the extremities of the fingers fall perpendicularly on the part under examination.*

A too strong percussion excites pain, an unequal one gives results unworthy of confidence; this will also happen if we strike on dissimilar parts; as, for instance, alternately a rib and an intercostal space; or, if the fingers are held in different positions at opposite sides. It is also necessary not to examine at once all the points on one side before passing to the examination of

* The stethoscope itself, as a means of percussion, appears, in some cases, to be preferable to the hand, as it always strikes in a perpendicular direction, and can only come in contact with the prominent parts of the ribs.

the opposite one, as we are thus liable to forget the particular results which we may have obtained; it is better to examine in turn the corresponding parts of each side.

The alterations of sound which take place in disease, may be reckoned as three in number, viz. dull, obscure, or clearer than natural; in some cases the sound is wanting altogether. Whenever the lung loses its elasticity, and becomes engorged, without however entirely losing its permeability, the sound will become dull or obscure, according as the sanguineous infiltration of the pulmonary tissue is more or less considerable.* This alteration is produced by the first degree of pneumonia, and by œdema of the lung. The sound disappears altogether in two cases; first, when the lung loses its permeability, from the abundant exhalation of blood into the areolæ, and the interlobular cellular tissue, thus becoming dense, and resembling much the appearance of a portion of liver; and secondly, when it is compressed and pushed inwards either by some growth accidentally developed in its own sub-

* Except in the case of pleurisy, dulness of sound on percussion always arises from the increased specific gravity of the lung.

stance, or in the cavity of the pleura; or when this latter is filled by any liquid.

In these cases, a greater or less portion of the side affected still retains its sound on percussion, according as the hepatization, accidental tumour, or effusion, may be more or less considerable.

The sound is louder than in the state of health, when (if I may be allowed the expression) the pulmonary tissue is rarefied, as in emphysema, or when the cavity of the pleura is filled by air or other gazeous fluids.

If I have not spoken of percussion on the precordial region, in diseases of the heart, it is on account of the rarity of meeting with hypertrophies sufficiently large to cause a complete want of sound; and also, that in cases where the sound is simply *obscure*, we have no data to form a conclusion, as we cannot establish any just comparison between this and the opposite side. This remark is just, if we have not had occasion to see and examine the patient for some time; but if we can compare the actual with the previous state, and find that there is any difference with respect to sound, *then* will percussion furnish signs of the utmost value towards forming a true diagnosis.

The facts which we learn from percussion are of great value, however it often happens that the sound of the chest is altered by causes foreign to the affections of its own organs. Thus any large tumour developed in the cavity of the abdomen, or ascites, will diminish the sound by contracting the thoracic cavity, and thus pressing on the lungs; but never does a cause independent of the pulmonary organs produce a complete want of sound.

"We cannot however deny," says M. Lænnec, "that this method of exploring the lung leaves us yet much to desire. It frequently indicates nothing in pthisis pulmonalis; and in no case does it enable us to distinguish this disease from chronic pneumonia. Even in acute pneumonia, where the sanguineous infiltration occupies only the centre of the lung, or when the two lungs are affected at once in a slight and nearly equal manner, percussion is but a feeble aid. It gives us no sign by which we can distinguish pneumonia from pleurisy, from hydrothorax, or other effusion into the cavity of the pleura. It furnishes no means of recognising pneumothorax, or rather it becomes an almost unavoidable source of error in this case. It only shows diseases of the heart

when this organ has attained a great size; and frequently death cuts off the patient before the disease has arrived to this degree. It gives no indications of aneurism of the great vessels, unless in cases where the application of the hand, and sight itself, put the matter beyond a doubt. The results of percussion are besides doubtful when the chest is deformed, even to a slight degree, by the effects of *rachitis*. To conclude, they are very uncertain, and even of no value when the integuments of the chest are infiltrated with serum, or loaded with a great quantity of fat, and above all, when they have become flaccid from a slight diminution of this excessive obesity.

OF AUSCULTATION.

The word *auscultation* is applied to the examination, made by means of the ear, of the different sounds which the circulation of the air, the reverberation of the voice, or the beatings of the heart, produce in the cavity of the chest.

Auscultation may be mediate or immediate. The application of the naked ear to the different points of the chest, is called *immediate auscultation.* It is not only inconvenient and disagreeable in many cases both to the patient and physician; but it is besides, far from giving the satisfactory results which it would seem to promise. The sounds which are thus heard are not perfectly distinct, or, if I may be allowed the expression, *defined;* transmitted by the whole surface of the head, which is in contact with the chest, they appear to have so much intensity that we cannot appreciate their shades of difference, and they are confounded with one another without it being possible to distinguish exactly the place where each is produced; the rubbing of the

head during the elevation and depression of the chest adds also to the confusion.

In fine, although useful in some cases, there are many where this method is not applicable: the ear cannot be placed on every point of the thorax, particularly among females, where decency alone suffices to interdict this mode of auscultation. These numerous inconveniences prevent us from having recourse to this method as often as we would wish; but it has now been superseded by another. I mean the use of the stethoscope, an instrument as simple in its construction, as it is easy in its application, and which M. Lænnec has shown to be so fruitful in results, so advantageous, I will even say indispensable, in the practice of medicine.

I do not intend, in this place, to enter into a particular description of an instrument so well known as the stethoscope; let it suffice to say, that M. Lænnec has, after many experiments, determined that the cylindrical form is the best; that the wood of which the instrument is made should neither be very light nor very dense; that its length may be about a foot; its diameter from an inch to an inch and a half; and that it should be bored longitudinally by a tube three

lines in width. In using the stethoscope, we should hold it as we do a writing pen; the extremities of the fingers so placed that we shall feel at once the end of the cylinder and the point of the chest where it is applied. It is necessary that the instrument shall be held perpendicular to this point, that it should bear upon it with its whole surface, and in cases where excessive emaciation has rendered the intercostal spaces concave, and the ribs projecting; that the inequalities shall be filled with lint, or some other soft substance.

The ear is to be applied upon the extremity opposite to that which carries the stopper. Custom will teach us the degree of force with which we should apply it in each case.

It is necessary to strip the patient of the greatest part of his clothes covering the chest; for if they are too thick, or are made of wool or silk, they produce, by their friction, sounds very similar to those which the stethoscope enables us to hear in the cavity of the chest. In our examination it is above all things necessary, that we shall not draw any conclusion until we have applied the instrument for some time; as the peculiar buzzing sound produced in the ear of the listener after the first application of the instrument,

the embarrassment of the patient, and the beating of the heart, hinder the production of the sounds, or prevent us from appreciating them. In exploring the force of the heart, and the phenomena produced by the voice, the instrument is to be furnished with its stopper; but in examining the respiration, or the sounds produced in some diseases of the heart, this appendage is to be removed.

The phenomena with which we thus become acquainted are divided into natural and pathological. The first are those which exist in the healthy state of the thoracic viscera. It is highly necessary that we study these with the greatest care and attention, lest we should confound them with such as are the genuine offspring of disease.

NATURAL PHENOMENA OF RESPIRATION.

The natural phenomena of respiration may be divided into two classes, viz. those which relate to the motions of the thorax, and those which

arise from the particular sound of the respiratory murmur.

In a healthy man, not agitated by any passion, inspiration and expiration should be performed slowly and regularly, without the painful effort of any muscle; their rhythme should be constant and uniform; all the ribs should be elevated; and the dilatation and contraction, unless in cases of deformity, should be equally marked on both sides. The succession of the respiratory motions is more or less rapid in different individuals; in general there are twenty complete respirations in the minute, and every fifth is the strongest. In women, children, and weak individuals, its frequency is greater. The passions, exercise or repose, the quality of the air, &c. cause the rhythme to vary constantly; during sleep respiration is less frequent and deeper.

When respiration is produced by the intercostal, and other respiratory muscles, it is called *thoracic*; when by the action of the diaphragm alone, *abdominal*.

The sound of respiration varies, first, according to the different parts of the chest examined; secondly, the frequency of respiration; and,

thirdly, the particular conformation, the age or sex of the individual.

When we apply the stethoscope to the chest of a healthy person, we hear, during respiration, a slight but very distinct murmur, which indicates the penetration of the air into the cells of the lung, and its expulsion.

This murmur is nearly equally strong at every point of the chest, but especially where the lungs are nearest to the surface; that is to say, in the superior lateral, and postero-inferior parts. The axilla, and the space comprised between the clavicle and edge of the trapezius, are the points where it is heard with the most intensity; over the larynx, the trachea, and root of the lungs, the respiratory murmur is distinctly heard; but it has a particular character, which causes us at once to perceive that the air is passing through a canal of greater diameter than the cells of the lung. In these situations we do not distinguish the expansion of the pulmonary tissue, and the air seems, during inspiration, to be drawn in through the cylinder, during expiration, to issue from it. The sound of this respiration, which is called *tracheal*, may be exactly compared to that produced by a pair of bellows.

The sound of respiration is more distinct as the latter is more frequent. A slow and deep inspiration is sometimes scarcely heard; hence it is often necessary to desire those whom we examine to breathe quickly and strongly.

In children, women, and men of an irritable habit, the respiratory murmur is distinct and sonorous; the expansion of the cells is more perceptible, and the sensation is such, that they appear to be more dilated than in the lungs of a healthy man. This difference of sound is perceived most during inspiration. We find it also better marked as the person is younger. It generally remains until puberty, or a little beyond that age. In adults the intensity of the respiratory murmur varies much; there are many healthy persons in whom it is scarcely heard, unless when they make a strong inspiration; in these cases the respiration is generally frequent. In some individuals, on the contrary, it is distinct, and even similar to that of infants, and these persons seem more disposed to diseases of the pulmonary organs.

PATHOLOGICAL PHENOMENA.

The pathological, like the natural phenomena, may be also divided with great advantage into those which relate to the motions of the thorax, and those derived from the character of the respiratory murmur.

In the state of disease, the motions of the thorax present a crowd of varieties, which may be reduced to the following divisions. They are either frequent or unfrequent, quick or slow, regular or irregular, great or small, equal or unequal, free or difficult, complete or incomplete; to conclude, respiration may be abdominal, or completely thoracic.

In order to observe and appreciate these different alterations, it will be necessary, if the patient's strength permits it, that he shall be made to sit up, in order that nothing may interfere with the muscular power producing respiration; both arms should hang down by the sides of the thorax, which is to be uncovered; but the most usual alterations are sufficiently marked to render these precautions for the most part unnecessary.

With relation to the number of inspirations and expirations in a given time, respiration may be *frequent* or *unfrequent*. It is *frequent*, when in an adult, more than from eighteen to twenty respirations are made in the minute; *unfrequent*, when fewer take place. This frequency is natural to infants, women, or persons of a nervous temperament; it occurs after exercise or strong emotions; in hot climates, or in very elevated situations, from the smaller quantity of oxygen in a given volume of air. It is also observed, (independently of any thoracic affection,) in worm diseases; in all spasmodic complaints; and generally speaking, in the whole class of the pyrexiæ.

Unfrequent respirations are generally seen only in the comatose and hysteric affections, or during the last moments of life.

Pain in the chest, every obstacle to the free circulation of air in the bronchial tubes, and every alteration which renders the pulmonary tissue unfit for respiration, are the causes of *frequency*: suspension of the nervous influence, and weakening of the muscular powers, those of *unfrequency*.

Respiration may be *quick* or *slow*. It is *quick*, when the inspiratory motions are short, rapid, and sudden; *slow*, when they are long and gra-

dual; when both quick and frequent, respiration is called *accelerated*; this may be carried to panting, and will then constitute *panting respiration.*

Quick respiration is sometimes met allied to the unfrequent variety among some robust subjects, also in acute diseases, and in the last moments of life.

The quickness of respiration appears to arise from the same causes as its frequency; its slowness is observed under the same circumstances as its unfrequency, which it often accompanies.

When the inspirations and expirations succeed at equal intervals, respiration is called *regular*; it is *irregular*, when these intervals are differently prolonged; *intermittent*, when one or more inspirations take place later, or fail altogether; *interrupted*, when the expiration seems to take place before the inspiration was finished. These different states are met with in inflammations of the chest and abdomen, and also in the nervous affections.

Respiration is called *great*, when a perfect expiration is succeeded by a slow or quick inspiration, accompanied by a great enlargement of the chest; *small*, when the dilatation is hardly perceptible.

Respiration is called *high*, when the chest remains elevated, the inspiration not having been preceded by a complete expiration. This occurs in pneumonia, where the respiration is frequent, small, and quick.

Great and unfrequent respiration is observed especially in cerebral fevers at the approach of phrenitic delirium.

The smallness of respiration is most frequently a symptom of affections of the chest.

Respiration is *equal*, when the inspiration, whether great or small, quick or slow, is followed by a similar expiration; *unequal*, when either of these motions is stronger or more prolonged. The typhoid fevers, and the most of the spasmodic affections and asthmas, present examples of it. It is a constant symptom in pleurisy and acute pneumonia. When the pleura is inflamed, the inspiration is *quick*; and the expiration, although very short, appears long when compared to the inspiration; the seat of the pain in this disease accounts easily for the phenomenon. When the lung is inflamed, expiration, on the contrary, is the shorter of the two; this motion, which cannot be performed without painfully compressing the affected organ, appears hardly to take place,

so that the chest remains always elevated. *High* respiration then, depends on the difficulty of expiration.

Respiration is *free* when it is performed without difficulty; when, in its production, the great accessory muscles are called into action, or when the proper inspiratory muscles contract with force, and as it were convulsively, it is termed *difficult*. This difficulty of respiration is sometimes perceived by the mere inspection of the neck. We see the scaleni hard, prominent, and trembling; and the same appearance is observed in the intercostal muscles of an emaciated patient.

Of this state there are different degrees from difficult to suffocating. In the last case, the patient, threatened with immediate suffocation, cannot remain in the horizontal position; sitting and bending himself forwards, he seeks a solid support for his hands, and thus fixing the superior extremities, he painfully contracts the great muscles of respiration, the whole effort of which is concentrated on the chest, which is greatly dilated. This state of respiration is called orthopnœa; it is frequently observed in the attack of asthma, in diseases of the heart, and sometimes

becomes habitual in persons affected with emphysema of the lung.

The most of the diseases of the chest, and a great number of those of the abdomen, cause difficulty of respiration. Thus, every obstacle to the entrance of air into the lungs, or to the dilatation of the thorax, whether it does or does not exist in this cavity, may equally give rise to difficulty of respiration.

Complete respiration is that produced by the equal concurrence of the two lungs; it is characterized by the extent of motion of the thorax, and its equality of force. *Incomplete* respiration is that where one side of the thorax remains immoveable, either wholly or in part, or at least partakes of much less motion than the opposite side.

This is one of the most constant and certain symptoms furnished by the examination of the thoracic motions; it belongs almost exclusively to diseases of the chest; it is often sufficient to point out the existence of pleurisy or pneumonia in infants; and in all cases, by indicating at once the seat of the disease, saves the patient much useless questioning and fatiguing examination. It sometimes depends on an inflammation of the lung, sometimes on pleuritis; simple pleurodyne may

also produce it. It is not rare to meet with individuals exhibiting this phenomenon, although in the enjoyment of perfect health; but it is then the result of a former disease, which has caused numerous adhesions between the two pleuræ.

Abdominal respiration was mentioned before. Here the abdomen is elevated during inspiration, and depressed during expiration; the ribs perform no motion. We observe this phenomenon when the two lungs have become quite unfit for respiration; it is one of the most fatal symptoms, and generally precedes death. Respiration, however, is often naturally abdominal in old persons, whose costal cartilages become ossified by the progress of age; and in them, the resistance of these parts is opposed to that of the already weakened muscular action.

Thoracic respiration, which is only effected by the elevation of the ribs, without the concurrence of the diaphragm, is observed in all cases of intense extended inflammation of the abdominal organs, or in those where the abdomen is distended by pregnancy, or some accidental production.*

* See Collin. Des diverses méthodes d'Exploration de la Poitrine.

Such are the changes which the motions of the chest experience in their rhythme, facility, extent, and simultaneousness. We shall next treat of the pathological phenomena observed by examining the respiratory murmur.

The sound or murmur of respiration may be stronger or weaker than in the natural state; altogether inaudible, or similar to that produced by the passage of the air through the trachea. It may be *cavernous*, as when the air passes into an excavation in the lung, and lastly, it is heard combined with the different rales.

When the respiratory murmur is stronger than in the natural state, it bears a great similarity to that of children, and on that account has been termed by M. Lænnec, puerile respiration. This augmentation of the sound of respiration is not caused by any morbid alteration of the lung at the part where it is heard. It is observed in healthy parts, whose action is, as it were, increased for a time, in order to make up for that of the diseased portions.

Puerile respiration is met with in one lung, when the other has lost its permeability, as from inflammation, tubercular developement, &c. It is heard in pulmonary catarrh, after the reappear-

ance of the murmur of respiration, and in some cases of asthma and hysteria; but here it is combined with the most distressing dyspnœa. When a lung is but partially affected, puerile respiration is heard in the sound portions.

The weakening or diminution of the respiratory murmur can only be ascertained by its examination at different parts of the chest, for it seldom happens that respiration is weakened in both lungs at once, or even in the entire of one. The intensity of murmur varies from the smallest diminution, to the most complete nullity; its diminution may arise from many causes: thus it is produced by the incomplete obstruction of the minute bronchial ramifications, arising from thickening of their membranes, or the presence of mucus; it may occur also when there is an abundant crop of tubercles disseminated through the pulmonary tissue; we find it in pleurisy, while the false membranes are yet soft, and only beginning to be organised; and lastly, it may arise from the diminished action of the thorax itself.

The diseases in which we meet with absence of the respiratory murmur over a more or less considerable portion of the lung, are, *pleurisy*, ac-

companied by effusion; *pneumonia*, in its advanced stages; *emphysema*; *pneumothorax*; and *pulmonary catarrh*.

It rarely happens that tubercles are developed in such quantity as to suppress altogether the murmur of respiration over a considerable portion of the lung. When absence of respiration is met with in pulmonary apoplexy, it is always confined to a very circumscribed space.*

In pleurisy, accompanied with abundant effusion, the absence of the respiratory murmur is uniform, and so complete, that we absolutely hear nothing except in a space of about three fingers-breadth along the vertebral column; and even here it is heard with less force than on the opposite side. This total absence of the sound of respiration after some hours of disease, is a symptom completely pathognomonic of pleurisy with abundant effusion; even where the pleuritic pain does not exist, we can pronounce, without fear of error, that there exists an effusion into the cavity of the pleura; for the nullity of respiration in pneumonia takes place gradually: it seldom

* It may be laid down as a general rule, that nullity of respiration seldom extends over the whole of the lung; it is rarely met with at the clavicles, and seldom or never at the root of the lung.

occurs under the clavicles, and even in this case, not until days or even weeks after the accession of the disease.

When this phenomenon occurs in pneumonia, it is always preceded by the crepitating rale, and is indicative of the second and third stages of the disease.

Emphysema of the lung is the next affection in which we meet with absence of this respiratory murmur; but this absence is not constant; frequently, upon causing the patient to make a deep inspiration, a slight murmur is heard, accompanied by some of the hissing rale, to be described hereafter. This symptom, together with the clear sound obtained by the percussion of the chest, form the pathognomonic sign of emphysema.

In pneumothorax, the nullity of respiration is complete, except in the space between the posterior edge of the scapula and the spinal column; but this is not the case in emphysema. There is no rale heard in pneumothorax.

One of the most remarkable phenomena which pulmonary catarrh presents, is the suspension of the respiratory murmur in the affected part; this often happens suddenly, and ceases in the same

manner, after some efforts of coughing, or the expectoration of mucus. It is owing to the momentary obstruction of some of the bronchial tubes by mucus sufficiently thick and abundant to intercept the passage of air, and ceases as soon as this obstacle is removed. This phenomenon might easily lead a careless observer into error, and make him believe that the lung had become impermeable to air, or that there was an effusion into the cavity of the pleura; but it is easy to avoid this mistake, for when the part thus affected is examined by percussion, we find that its sound is perfectly clear, which would not be the case in either pneumonia or pleurisy, and besides, this absence is preceded and followed by the sonorous or mucous rale.

The tracheal, or as it is termed by M. Andral, the bronchial respiration, has been already described, when treating of the natural phenomena of respiration. It is heard in every case where the air cannot penetrate the pulmonary vesicles, as in hepatization of the lung, its condensation from tubercles, or a pleuritic effusion. It would appear to arise from the condensation of the pulmonary tissue, which, thus becoming a better conductor of sound, enables us to hear the

respiration, only occuring in the large bronchial tubes.

When an excavation exists in the pulmonary tissue, the sound of respiration, as examined over it, may be termed cavernous. It differs from the bronchial inasmuch as it gives us the idea of air entering from a number of small apertures, into a large and undefined cavity. It is difficult of description, but it may be said that the sound of inspiration is more *diffuse* than that of expiration, in which it appears as if the air was forced through a smaller number of apertures than those by which it entered.

The cavernous respiration is a sure indication of a cavity, however formed.

Whatever may be the intensity of the respiratory murmur, it is either *pure*, indicating that the bronchial tubes are perfectly free, or it is combined with different rales.*

* As there is not any English expression which would give a definite idea of the meaning attached to this word, I trust there is no occasion to apologise for its adoption.

OF THE RALES.

By the term *rale*, we understand any sound produced by the circulation of the air through the bronchial tubes, and pulmonary vesicles, differing from the natural respiratory murmur. These rales seldom occupy the whole of the lungs; they are most generally heard over a small part only, while in other parts respiration remains natural, or even becomes puerile; they indicate the narrowing of the bronchial tubes, or the existence of some liquid in the latter, or in the air cells of the lung; their difference of sound, their distance or vicinity, and the extent which they occupy, teach us both the place where they occur, and some of the physical properties of the liquids giving rise to them.

At a small distance from the place where any rale is heard, the respiratory murmur may be natural, although in the neighbourhood of a severely affected part.

These sounds accompany the cough when it is present, but it is more convenient to examine them during respiration; they may occur alone

or combined with one another, either in the same or in different points; some remain through the entire period of the disease which they characterize; others, which might be called intermittent, appear and disappear in turns; sometimes occupying one place, sometimes another, so that they are frequently wanting at the moment we wish to examine them.

There are four species of rale enumerated, viz. the *crepitating*, the *mucous*, the *sonorous*, and the *hissing* rale.

OF THE CREPITATING RALE.

This rale consists in a sound which has been well compared to that given by salt when decrepitating, or by a piece of dry lung when pressed between the fingers. It is difficult to explain its production; but it seems owing to an increased determination of blood or other fluid to the air cells of the lung. It is thus the pathognomonic sign of the first stage of pneumonia, but it also occurs, though with some modification, in œdema of the lung, and pulmonary apoplexy.

When pneumonic inflammation has been present for a short time, this rale only alters and obscures, but does not altogether conceal the natural respiratory murmur; but increasing with the progress of inflammation, it arrives at its maximum, and completely suppresses the natural sound of respiration. From its intensity, it is evident that we can judge of the degree of inflammation; thus when the natural murmur predominates, the pneumonia is slight, but when it is concealed, we may be sure that the inflammatory action is severe, and likely to terminate in hepatization of the lung.

When, on the contrary, the inflammation is about to terminate by resolution, the rale becomes distinct,* at the same time acquiring a more humid character; and the respiratory murmur becomes more evident, until its complete restoration has taken place; but when the lung is passing into hepatization, the diminution of the rale is not accompanied by the return of the respiratory murmur.†

* In this case it has been compared to the sound produced by the inflation of a bladder.

† In cases where the inflammation gains the superior part of the lung, the crepitating is frequently accompanied by the sonorous rale, indicating inflammation of the larger bronchial tubes.

In *œdema of the lung*, the rale which is heard is termed *subcrepitating*, a term which indicates its character well, as it is analogous to the first, but, as it were, a lesser degree of it, and produced by a fluid not so tenacious as that which appears to give rise to the crepitating rale; it also differs from it in being constant during the presence of the disease.

In *pulmonary apoplexy* or *hæmoptysis*, the crepitating rale is heard in circumscribed points of the lung, more or less numerous. In the intervening spaces, respiration is heard natural, sometimes even puerile. In course of time, the rale ceases to be heard, and is succeeded by a *mucous rale*, apparently formed by large bubbles, indicating a copious exhalation of blood into the air cells and bronchial tubes, over the whole extent of the affected part.

As the crepitating and mucous rales are regarded by M. Andral as mere varieties,* I think it better to describe the latter before commencing the pathology of pneumonia, in which case I shall not be under the necessity of dividing the account of this disease. I shall then describe œdema of the lung and pulmonary apoplexy.

* Clinique Medicale. Tome II.

OF THE MUCOUS RALE.

This rale is that produced by the passage of air through mucus accumulated in the trachea or bronchial tubes, or through softened tuberculous matter in cavities of the lung. When it has its seat in the trachea, or large bronchial tubes, it can be heard without the aid of mediate or immediate auscultation. The mucous rale denotes by its nature the viscid state of the liquid which fills the air passages, and gives the idea of a successive formation of different-sized bubbles, occurring in a viscid fluid. Sometimes it is obscure, and produced at distant intervals, in other instances it is distinct and continued; in the first case, showing that the collections of mucus producing it are scattered through the lung; in the second, that the bronchial tubes are almost filled. The highest degree of it has been termed "gargouillement," or the gurgling sound.

As the crepitating and mucous rales appear to derive their origin from the mixture of air with liquids of different tenacity, they may be considered as only different degrees of the same rale,

depending on their situation. "Thus," says M. Andral, "we hear 'gargouillement' in large excavations, the mucous rale in the larger bronchial tubes, in the smaller a rale between the mucous and crepitating; and finally, the crepitating rale is characteristic of inflammation in the smallest bronchial ramifications, and in the air cells of the lung. These varieties of the same sound may be termed the cavernous, the bronchial, and the vesicular rales."

The mucous rale is met with in all diseases of the lung, in which there is an increased secretion from the mucous membrane of the bronchial tubes, it is therefore characteristic of pulmonary catarrh in its advanced stage. It also occurs in pneumonia; in the first stage, where the disease is terminating by resolution; in the second, where there is an accumulation of mucus in the large bronchial tubes; and in the third, or suppurative stage, where an abscess is beginning to be formed. In the advanced stages of phthisis, where softening of the tubercles has taken place, it constitutes the proper "gargouillement" of the French authors; which occurs when there exists an excavation half filled with fluid matter, and communicating with the bronchial tubes. This "gargou-

illement" is heard on the surface exactly corresponding to the excavation; and although in this case we cannot hear it with the naked ear, yet under the cylinder it is as often as distinct as the rattle in the throat of a dying person. This sign announces the existence of an excavation in a manner almost as certain as pectoriloquism, and often makes its appearance some days before the latter symptom becomes completely evident. When this variety of mucous rale is not very distinct, it cannot alone constitute a pathognomonic sign of the softening of tubercles, or the formation of a cavity, because partial pulmonary catarrh may sometimes present the same phenomenon, but when strong and permanent in the same place, it is never equivocal.

When the tubercular mass is softened to its greatest extent, there is often heard, instead of the rale, a manifest fluctuation. In this case, when the patient speaks or coughs, there is frequently heard a metallic sound to be described hereafter.

In some cases, the rale resembles the sound produced by the liquid coming from a bottle completely inverted. This sound is only heard momentarily, and appears to M. Lænnec to coincide with the existence of numerous anfractu-

ous excavations, communicating with one another by canals of some length and small diameter.

In pulmonary catarrh the rale first heard is the sonorous, to be described hereafter. The mucous rale is not heard until the disease has made a certain progress, it then becomes evident, still, however, permitting the respiratory murmur to be heard.

When catarrh is partial, as most frequently happens, the rale is only heard over the affected part; when it extends over the whole of one lung, or a considerable portion of both, the case is always severe; heard over the whole extent of both lungs, the disease is generally fatal, unless where the patient is very young.

PATHOLOGY OF PNEUMONIA.

Pneumonia may be either acute or chronic. Of acute pneumonia, M. Lænnec describes three degrees; first, that of sanguineous infiltration; secondly, that of hepatization; and thirdly, that of purulent infiltration. The sanguineous

infiltration answers to the "engouement" of M. Andral; the hepatization to the "*ramollissement rouge*;" and the purulent infiltration, or grey hepatization of Lænnec, to the "*ramollissement gris*" of the above author. The anatomical characters of acute and chronic pneumonia are considered by Lænnec as the same; however M. Andral has described two other states of the lung as occurring in chronic pneumonia, these he terms the red and grey induration of the lung.

Acute pneumonia.—In the first stage, the lung is heavier than in the natural state; exteriorly, it is of a livid or violet colour, and its solidity is greatly increased. It still, however, crepitates under the hand, but in a diminished degree, feeling as if it were engorged with some liquid. When cut, its tissue appears of a livid red colour, and completely infiltrated with a frothy and more or less sanguinolent serosity, which flows abundantly from the surface of the incisions. We can still however, distinguish the areolar and somewhat spongy texture of the lung.* The passage

* In this stage the lung has been compared to that of a fœtus. By pressure, and repeated washing, it may be restored to its natural state.

from this to the second stage, is marked by the diminished consistence of the pulmonary tissue; it becomes very friable, while the exudation is less abundant, and not so frothy as in the first stage. In this state, the lung may be well compared to a piece of spleen.

When the lung arrives at the second degree of inflammation, or the state of hepatization, the pulmonary tissue no longer crepitates under the hand, nor does it float in water; it resembles a portion of liver gorged with blood. Exteriorly, its colour is not so livid as in the first degree, but interiorly, it is of a more or less deep red colour, and on its surface, the spots formed by the black pulmonary matter, the ramifications of the bronchial tubes, and the thin cellular divisions which traverse the pulmonary tissue, are well marked. These last divisions, which are seen with difficulty in the healthy state, become now very apparent; they do not seem to participate in the inflammation, and on that account are rendered extremely evident by their white colour. If we examine the surface of the incisions with a clear light, the substance of the lung presents nothing of its natural cellular appearance, but seems to be

formed of little grains of a reddish colour, and flattened spheroidal shape.

In this state the pulmonary tissue is easily torn, and constitutes the "ramollissement rouge" of M. Andral. The lung seems as if more voluminous than in the state of health; but this appearance is deceitful, as it arises from the non-collapsing of the lung, owing to its increased solidity.

In the third degree, the pulmonary tissue, still preserving the granular appearance which has been described before, assumes a pale yellow or greyish colour, constituting what is called the grey *hepatization* of the lung, or "ramollissement gris" of Andral.

Upon incisions being made into a lung arrived at this degree, a viscid opake and purulent matter, having a faint nauseous smell, flows in greater or less quantity; the substance of the lung is soft and friable, and the whole bears a strong resemblance to a sponge dipped in pus.

When a cavity is formed, which rarely occurs, its parietes, according to M. Lænnec, consist of pulmonary tissue infiltrated with pus, and in a state of softening which diminishes with the distance from the centre of the abscess.

"When the inflammation is chronic," says M. Andral, "the lung may be affected in the preceding manner, but it also presents two other states which are not observed in the acute inflammation of this organ, and in which the pulmonary tissue, instead of being softened and imbued with fluid, is hard and dry. It sometimes presents a pale red colour, but most commonly has a greyish tint.

As we have admitted the existence of a red and a grey softening in the acute inflammation, so in the chronic, we must also admit of a red and grey *induration* of the lung." *

The three stages of pneumonia are frequently met with in the same lung. Sometimes one of the lungs is inflamed to the third degree, while the other presents the first and second degrees in different portions. When the three degrees are met with in the same lung, they are either divided by well marked lines, or pass into one another by insensible shades. The passage from the one degree to the other, as from the first to the second, is characterized by a red tissue from

* Both acute and chronic pneumonia may terminate though rarely, in gangrene. See Appendix.

which a great quantity of frothy and sanguinolent fluid exudes: it is still however a little crepitating under the hand; and we can distinguish in it, non-crepitating parts of a redder colour and more firm consistence, whose surfaces when cut, are of a granulated appearance; they are in fact portions of the lung in a commencing state of hepatization.

The transition from the second to the third stage, is characterised by the appearance of yellow uncircumscribed spots, passing by insensible degrees into the hepatized portion of the lung.

Pneumonia seldom commences in the superior part of the lung; when it does so, the progress of inflammation is said to be more rapid than when the inferior parts are first affected. It is in the inferior parts that inflammation generally commences. When we observe a lung in which the three stages occur, we always find the most advanced one in the lower lobes.

An inflamed portion is sometimes found towards the centre of the lung, while all around it the pulmonary tissue still crepitates, except at the middle of the inferior surface, which then is always in a state of inflammation.

The whole of both lungs is seldom inflamed

at once to the third or even to the second degree; sometimes, however, the entire of one lung, and even the half of the other, become impermeable to air. The complete interruption of respiration will sufficiently explain why the first of these cases is so seldom met with; indeed there are some cases where death has taken place before the fourth part of the lung was affected.

"Pneumonia," says M. Lænnec, "even when it has arrived at the third degree, or even when purulent infiltration has taken place, may yet terminate by absorption of the pus, and without disorganization of the pulmonary tissue. If, in this case, death happens during convalescence, (which frequently occurs in old patients,) the pulmonary tissue no longer presents the hepatic hardness, nor even the degree of density which pneumonia in the first degree, or œdema of the lung produce; it crepitates slightly under the hand; it sometimes floats in water; when cut, it allows a certain quantity of very liquid pus to flow out; the surface of the incisions is of a dirty yellowish or slightly green colour, which forms a strong contrast with the remaining healthy portions of the pulmonary organ. When resolution is far advanced, this tint alone remains. The

tissue of the lung is moister than in the state of health, but no perceptible quantity of pus flows from it."

Pneumonia may be either single or double; *single*, when occurring in one lung only, *double*, when both are affected. In the one lung it may be general or partial. It most frequently commences in the inferior lobe.

M. Andral mentions, that of 151 cases of pneumonia admitted into the hospital of La Charité, in 90 the right lung was affected, in 38 the left lung; 17 were cases of double pneumonia, and the seat of 6 others was not determined.

Of 59 well described cases in the works of Morgagni, Stall, De Haen, Pinel,* and Broussais,† 31 were of the right lung, 20 of the left, and 8 of both lungs at once. Thus, on the whole, of 210 cases of pneumonia, 121 were of the right side, 58 of the left; 25 were double, and the seat of 6 was not determined.

Of 88 cases under the care of M. Andral, 47 were of the inferior lobe, 30 of the superior, and in 11 the whole lung was inflamed at once.

Chronic pneumonia is considered as being

* Medicine Clinique. † Traite des Phlegmasies Chroniques.

much rarer in its occurrence than the acute species. Of 112 cases of pneumonia, M. Andral considered one only as chronic; it alone continued for more than thirty days. There is a case of well marked chronic pneumonia related by M. Bayle,* which was mistaken for phthisis pulmonalis; but this was before the discovery of mediate auscultation.

The following cases of pneumonia are admirably illustrative of the use of the stethoscope in this disease; indeed in the second, without the use of this invaluable instrument, *nothing* could have been known about the true nature of the disease. The first, with its supplementary observations, is from the work of M. Andral, already quoted; the second formed the subject of an excellent thesis by M. Lenormand.†

CASE I.

A carpenter, aged 32, was seized with a violent shivering on the night of the 20th of April 1822. On the morning of the 21st, he felt a pain, at

* Recherches sur la Phthisie Pulmonaire, obs. 46.

† De la Pneumonie Latente. Paris, 1824.

first occupying the top of the left shoulder, but which soon extended over the whole left side of the thorax; it was augmented by coughing and by deep inspirations; and when he lay on the left side, it became insupportable. He had a dry cough and sweating in the evening. During the seven following days he kept his bed, and only took some emollient drinks; on the evening of the 27th he entered the hospital, was immediately bled; and during the night was delirious. On the morning of the 28th he had short and hurried inspirations; frequent cough, with a considerable quantity of transparent, viscid, and sanguinolent expectoration. The pain, less acute than on the preceding days, was felt on percussion over the left side from the axilla to the last ribs. He lay on his back. Upon percussion, the sound was dull, laterally and posteriorly, over nearly the whole of the inferior lobe of the lung. In this situation a slight crepitating rale was heard, without any mixture of the respiratory murmur. It was concluded, from these observations, that the inferior lobe of the left lung was partly engorged and partly hepatized.

Pulse frequent, strong; skin hot and moist. The sweatings had continued every evening from

the commencement of the disease. Tongue white; anorexia; thirst moderate; constipation.

He was bled to twelve ounces, and thirty leeches applied over the left side. He had delirium during the night, which continued the next morning; but the respiration was easier; the sputa were less bloody; and the crepitating rale much stronger and more extended; seeming to announce that the hepatized portion of the lung was returning to the state of simple sanguineous infiltration. Less fever. As far as the pneumonia was concerned, the patient was evidently better; but the delirium proved a cerebral congestion, the more to be feared, as it should have diminished were it sympathetic with the thoracic affection. Enough of bleeding had been practised, as the patient was naturally of a weak constitution. Two blisters were applied to the legs, as revulsives at once from the head and chest. The delirium ceased towards evening, and did not again appear. On the next day he was in the same state; on the eleventh and twelfth days of his disease the sound of the chest was less dull, and the crepitating rale more distinct. The patient felt no more pain; could make a deep inspiration easily; the sputa scarce-

ly bloody, had become of the catarrhal character; moderate fever; in a word, every thing proved that resolution was going forward. On the thirteenth day a blister was placed on the left side of the thorax. During the fourteenth and fifteenth days, the natural respiratory murmur began to be heard, though still mixed with a crepitating rale. Sound of the chest no longer dull; sputa catarrhal. On the sixteenth day, respiratory murmur more distinct, and only at intervals, and in some points, mixed with the crepitating rale. Pulse still a little frequent, but no other sign of fever. On the seventeenth day the respiratory murmur was every where distinct and natural. Convalescence.

Let us attend to the signs furnished in this case by auscultation and percussion. The sound was at first dull, and the crepitating rale feeble, without any mixture of respiratory murmur; from these signs, it was inferred that hepatization had already taken place. Further on, when the diminished fever, less dyspnœa, the catarrhal state of the sputa, the progressive return of the sound on percussion, all announced the resolution of the pneumonia; auscultation pointed out the stages

of this desirable change, each day indicating the passage of the pulmonary tissue from the state of hepatization, to that of simple sanguineous infiltration. The greater or less intensity of the crepitating rale proved these different states of the lung with an almost mathematical correctness. If this rale is very strong, without any mixture of the respiratory murmur, we may be certain that the whole of the lung where it is heard is only simply engorged; but that the sanguineous infiltration is very considerable. If the respiratory murmur is heard with the rale, the infiltration is less considerable, and much of the lung is still healthy. Sometimes the rale is heard only in insulated points, at long intervals, or even in a continued manner; but so feeble that it requires much attention and practice before it can be distinguished, and as it were separated from the surrounding murmur of respiration, which increases as the rale diminishes; in this case, the inflammatory action is very slight, or circumscribed.

At other times, although the crepitating rale shall become more and more feeble, yet the respiratory murmur is not re-established; there is then a passage from the first to the second degree; a mixture of hepatization and sanguineous infiltra-

tion. It is rarely that we find total absence of the crepitating rale, even where the hepatization is considerable. In the latter case we have the tracheal respiration, and bronchophonia. When the portions of the hepatized lung become permeable to air, it is announced to us by the return of the crepitating rale, or by its greater intensity, if the latter has continued. It is a curious circumstance, that long after the other symptoms of pneumonia have disappeared, the respiratory murmur is still mixed with a little of the crepitating rale. What are we to conclude from this fact, but that the inflamed portions of lung generally return to their natural state in a much slower manner than could have been believed before the discovery of auscultation? Hence the liability to relapse in cases of pneumonia; hence also we may form some idea of the precautions necessary while this rale exists. If these are neglected, the disease, latent in its last periods, may return to the acute state; or what is more common, the lung may pass into the state of chronic inflammation, terminating in a tubercular degeneration of this viscus, for which the patient may have been predisposed.

The following is a remarkable case of acute

latent pneumonia, accompanied by acute circumscribed *latent* pleurisy of the right side. The disease was promptly fatal, and was constantly marked by violent symptoms of inflammation of the mucous membrane of the intestinal canal, which, upon dissection, was found healthy.

CASE II.

A man, aged sixty-one years, of a strong constitution, had enjoyed very good health until the 29th of November, 1823, when he accidentally breathed an irritating vapour, which was exhaled from a crucible containing silver in fusion. He immediately became drowsy, with a sense of weight in the head, and was obliged to quit his work. He continued in the same state till the 1st of December, when he had general sickness and nausea. On the 2d, he had frequent and violent efforts of vomiting. The pit of the stomach was painful. General illness much increased. *Respiration not at all laborious. He had neither cough nor pain in the chest.* He entered the Hospital on the 3d, on the 4th he had pain in the epigastrium, which was augmented on pressure. Headache. Abdomen hard, tongue red,

and somewhat dry; great thirst; no appetite; frequent evacuations of a green colour. Cough rather frequent. Sputa liquid, yellowish, *not at all viscid; respiration apparently free; no pain in the chest;* pulse frequent, full but soft; urine very red; sensation of weakness and pain in the lower extremities; sound on percussion natural over the whole anterior part of the chest; posteriorly, it was dull over the three superior fourths of the right side. On the left, respiration was almost puerile; on the right side it was only heard at the lowest part, and along the spine; over the remaining parts on the same side, nothing was heard during inspiration but a distinct crepitating rale. Diagnosis. *Pneumonia in the first degree of nearly the whole right lung.*

5th. General prostration; delirium; respiration more frequent; pulse intermittent. Abdomen hard, painful on pressure; sputa in small quantity, of the same character as before; sound of right side less clear; strong bronchophonia below the right clavicle, and posteriorly on the same side; crepitating rale very slight. *Diagnosis. The pneumonia has made progress, especially towards the upper part of the lung;* at four o'clock that day, general debility increased; abundant

and involuntary dejections; comatose delirium. Bronchial respiration anteriorly on the superior third of the right side, under the axilla, and posteriorly. The crepitating rale has disappeared. *Diagnosis. Hepatization of the superior part of right lung.*

6th. Stools less abundant during the night; much delirium till five o'clock in the morning; none at the hour of visit; intense thirst, which has continued during the night; tongue soft, more humid, and less red. Abdomen still swollen, but more soft, and not painful; respiration more accelerated, and accompanied by a tracheal rale; little cough; expectoration trifling. No bronchial respiration; over the whole right side the respiratory murmur is null; on the left, always puerile.

At four, P. M. Extreme prostration; tracheal rale very distinct; pulse small and frequent; tongue humid, soft, and slightly foul; intense thirst; epigastrium very painful on pressure; vomiting has ceased. Constipation. Intellectual faculties entire.

7th. Augmentation of all the symptoms; epigastrium continues painful; tongue pale and very

humid; pulse hardly sensible. Died at eleven, A. M.

Dissection.—The right lung voluminous, and in one mass, was almost covered by the costal pleura, which, adhering intimately to the lung, had been torn out with it, and preserved the impression of the ribs, though the pulmonary tissue presented no such appearance, as was proved by dissection. The two pleuræ, united throughout the whole of their extent, presented a cavity at the superior part of the lung, capable of containing a hen's egg. The parietes of this excavation were formed by the two pleuræ, and it was filled with a liquid brownish pus, which, coming from the lung, had passed into this abscess, in consequence of an erosion of the pleura pulmonalis. A similar purulent collection existed between the superior and middle lobe. The superior third of the lung was compact, and infiltrated with a semi-concrete pus, which, in many places, formed abscesses capable of containing a nut, many of which communicated with one another. The middle part presented the red hepatization and the inferior a strong sanguineous congestion. These three states were divided by well-marked lines of

demarcation, corresponding to the interlobular fissures.

The left lung was for the most part healthy, except at its posterior part, where it was inflamed to the first degree; the inferior lobe was beginning to pass into red hepatization. The heart was natural; its right ventricle containing a very adherent fibrinous concretion.

The abdominal viscera presented their natural aspect. The stomach was remarkably flaccid, its mucous membrane in some parts slightly injected, and towards the pylorus of a light red colour. The whole of the intestinal tube being opened, the end of the jejunum only was found with a vascular injection. The other viscera were healthy. Pancreas a little harder than natural.

PATHOLOGY OF ŒDEMA OF THE LUNG.

Œdema of the lung presents the following anatomical characters. When it occupies the whole of the lung, and is not of long duration, the pul-

monary tissue is of a pale grey colour, possessing some of the slight pinkish hue which is natural to it: its vessels appear to contain less blood than in the ordinary state. The lung, more dense and heavier than in the state of health, does not collapse upon opening the chest. It still, however, crepitates nearly as much as in the natural state; but the impression of the finger remains more strongly marked on it. When it is cut, there flows an abundant serosity, which is transparent, nearly colourless, and a little frothy.

These last characters are sufficient to distinguish this lesion from pneumonia in the first degree, in which the infiltrated serosity in the inflamed pulmonary tissue is strongly sanguinolent, and very frothy; besides, the characteristic redness of inflammation establishes a well-marked difference between the two affections. As to the rest, it is not rare to find in an œdematous lung some points inflamed to the first, or even the second degree, and around these points the transition from pneumonia to œdema is insensible and gradual. However intense the œdema of the lung may be, the spongy texture of the air cells remains without alteration. We always find it perfect, especially in the interior of the lung, and

when a certain quantity of serum has flowed out by incisions; but when the lung remains entire, it is difficult enough to distinguish the areolæ, because the serosity which fills them diminishes their transparency. When œdema of the lung is general and of long standing, it has commonly none of the sanguineous infiltration which is observed in the posterior parts of the lung in most dead bodies.

CASE III.*

A WOMAN, aged 47 years, entered the hospital Necker on the 20th of December, 1818, and then presented the following symptoms:

Face slightly yellow, considerable emaciation; œdema of the superior extremities, especially the left; respiration short and difficult, cough not frequent, sputa white, viscid, and mixed with a great deal of saliva; digestion tolerably good, little sleep for the last fifteen days.

The insertion of a seton on the left side relieved the patient much, rendering the respiration more free. A little laudanum procured her some sleep.

* Lænnec.

The patient got better about the end of January 1819. She coughed less and breathed more freely; the expectoration was very trifling, the œdema of the arms diminished much; and her other functions appeared natural.

Towards the beginning of February, the infiltration of the superior extremities increased slightly; and the legs began also to become œdematous. The secretion of the kidneys was suppressed for three days.

On the 8th of February she mentioned that from the time the urinary secretion was interrupted she had lost her sleep, been affected with nausea, and had dull pains in the region of the uterus. For some time emaciation had made considerable progress, and the swelling of the thighs had advanced to the abdomen. Almost the whole body, with the exception of the face, was œdematous; the abdomen was very large; but this tumefaction appeared to depend more on the infiltration of its parietes, than on an effusion into the peritoneal cavity, for no fluctuation was perceived.

During the following days, the œdema did not diminish, and she complained of some slight colicky pains.

On the 18th these pains were increased; the swelling of the abdomen and thighs was much augmented, irregular pulsations of the heart—pulse almost imperceptible; a slight shooting pain was felt since yesterday evening, under the left breast; the respiration was tolerably free, and heard by the stethoscope over the whole chest, but was accompanied by a slight crepitating rale.

Diagnosis. Œdema of the lung.—(Aperient drinks, frictions on the thighs, with acetum scillæ; four leeches on the left side). The pain of the side disappeared immediately after the leeching.

She continued alternately better and worse until the first of March, when she was again examined with the stethoscope. On both sides anteriorly the respiratory murmur was distinctly heard; but on the back and lower parts of the sides, the subcrepitating rale was evident.

On the 31st all the symptoms were increased, and she died on the 2d of April.

Dissection. The subcutaneous cellular tissue of the thorax was loaded with fat, and infiltrated with much serosity. The pleuræ contained less than a pint of limpid slightly yellowish serosity;

the lungs were almost everywhere adherent to the costal pleura by long, firm, and well-organized cellular bands; in both lungs the pulmonary tissue crepitated but little, and was infiltrated with a slightly frothy, colourless serosity, which flowed abundantly from incisions made with the scalpel, and gave a sort of semitransparence to the substance of the lung. The lungs were otherwise healthy, presenting no trace of inflammation, or the sanguineous infiltration frequently occurring in dead bodies. The pericardium contained about six ounces of serum; the heart was small, flaccid and pale. The internal surface of the aorta at its commencement was unequal, and its lining membrane presented spots of a reddish-violet colour; here the membrane was thickened; the pulmonary artery presented the same appearance.

PATHOLOGY OF PULMONARY APOPLEXY.

This affection consists in an induration of the lung equal to that of the most severely hepatized portion, but otherwise very different. This

induration is always partial, and never occupies any considerable portion of the lung; its most common extent being from three to four cubic inches. It is always very exactly circumscribed, and at the point where the induration ceases, the lesion is as characteristic as towards its centre. The surrounding pulmonary tissue is perfectly healthy and crepitating, and offers nothing analogous to that progressively decreasing density which is observed in pneumonia, as we remove from the affected part. We frequently observe, around the hæmoptysical collections, that the pulmonary tissue is of a very pale colour; sometimes, however, it is pink, or even red, and infiltrated or rather tinged with a certain quantity of red blood; but even in this case, the line of demarcation between the dense hæmoptysical mass, and the slight sanguineous infiltration, is always well marked.

The part affected with Pulmonary Apoplexy is of a very deep red colour, and similar in appearance to a clot of venous blood. The surface of the incisions is granulated, as in hepatization; but in other respects the aspect of these morbid alterations is entirely different. In hepatization the red colour of the inflamed pul-

monary tissue allows us still to perceive the black pulmonary spots, the vessels, and the slight cellular divisions which traverse here and there the tissue of the lung. It is this mixture which gives to the hepatized lung the appearance of certain species of granite. The same thing is observed in the third degree of pneumonia, and when the purulent infiltration has converted the whole of the lung into a yellow mass. In the hæmoptysical affection, on the contrary, the indurated part presents a completely homogeneous aspect, and its colour, almost black or of a deep brownish red, does not permit us to distinguish any trace of the natural texture of the lung, but the bronchial tubes and greater vessels, whose tunics even have lost their white colour, and seem as if tinged with blood.

If we scrape the surface of the incisions with a scalpel, we elicit a little semi-coagulated blood. The granulations presented by the cut surface are larger than those observed in hepatization. Sometimes the centre of these indurations is softened and filled with a clot of pure blood.

CASE IV.*

A MAN aged forty-five, had been liable to a feeling of suffocation upon taking exercise for many years. About the end of August 1818, he complained of permanent difficulty of breathing.

Upon entering the hospital he had the following symptoms: Face of a dirty pale colour; pulse hardly sensible in both arms; feet and legs œdematous; no appetite; thirst moderate; sleep interrupted by troublesome dreams. The respiratory murmur was well distinguished by the stethoscope, although the respiration was short and laborious. The chest resounded well over its whole extent, except in the region of the heart. The impulse of the left ventricle was very strong and sonorous; sound and impulse of the right ventricle moderate, that of the auricles null.

Diagnosis—Hypertrophia of the heart.—At the end of a month, he was so recovered as to be able to return to his occupations.

On the 16th of January 1819, he returned to the hospital, complaining of great difficulty of

* Lænnec.

breathing, especially when lying on the back; he had more ease when he bent himself forwards; and in order to procure sleep, he used sometimes to lie on the abdomen; but then felt a beating in the throat opposite to the top of the sternum. Since he was last in the hospital the serous infiltration had greatly increased, the dyspnœa was more considerable, accompanied by paroxysms of cough, and by diarrhœa. The pulse was not perceptible. The patient complained much of an acute pain in the epigastrium. The impulse of the heart continued very strong.

Orthopnœa increased daily, notwithstanding the use of local bleedings, sinapisms, aperient drinks, and digitalis; thus he continued until the 3d of February, when the respiration became still more difficult; the patient, experiencing occasionally severe attacks of suffocation, the intensity of which he diminished by inclining himself forwards. The cough was more frequent, and followed by expectoration of a thready mucus, mixed with some striæ of red blood. On the 4th of February, the patient threw up, almost without effort or cough, a large quantity of red frothy blood, mixed with but little sputa. The chest resounded well over its whole extent. In the in-

ferior part of the right lung, the respiratory murmur was scarcely heard. A mucous rale, formed by very large bubbles which seemed to dilate in passing through the bronchial tubes, was heard over almost the whole of the chest. Some of these bubbles were evidently perceived to break from excessive distention. This rale was strongest on the right side.

To the former diagnosis was now added, *Pulmonary apoplexy.* A small bleeding was ordered.

6th. Wandering pains in the abdomen, principally towards the epigastrium, want of sleep, pulse hardly sensible; he expectorates a sanguinolent and somewhat sanious matter; the chest resounds well anteriorly and laterally; rale much stronger on the right side, on which he always lies.

7th. Face sunk, voice almost extinct, great debility, a slight crepitating rale on the left side.

8th. He died on this day after a long and painful struggle.

Dissection.—The brain and its membranes presented nothing remarkable. The pericardium contained about an ounce of serum. The heart was three times its natural size. In the right

pleura were about six ounces of a reddish serum. The lung at this side adhered slightly to the ribs at its superior part. In its three superior fourths, it was reddened rather than infiltrated, by a very florid blood; its tissue in other parts was healthy, and somewhat dry. Towards its base, it presented a zone of about three fingers wide, and exactly circumscribed, traversing the entire thickness of the lung, and intersecting the pulmonary tissue, from which it was distinguished by its hepatic density, by its blackish red colour, and by the granulated aspect of the incisions made into it. Three or four indurations of the same kind, and equally hard, were remarked higher up in the same lung; but their size hardly equalled that of an almond. The largest of these indurations, over a great portion of its surface, was separated from the pulmonary tissue by a thin membrane, evidently one of the natural intersections of the lung.

The left pleura, like the right, contained some ounces of a reddish serosity; the left lung presented on its surface, and especially at its base posteriorly, a thin, yellow, opaque, and very soft false membrane. The pulmonary tissue was in general healthy; when pressed, a small quantity

of bloody serosity flowed from it. Towards the posterior part of its lower lobe, it contained in its parenchyma two or three indurations, similar to those of the right lung, and equally circumscribed. In both lungs the bronchial ramifications were slightly dilated, and filled with grey and opake mucus. The interior of the trachea was red, and also contained a grey and thready mucus. In many places, and especially in the small ramifications, the mucous membrane of the bronchial tubes was considerably thickened, and tinged of a violet red colour.

OF THE SONOROUS RALE.

This rale consists of a sound, sometimes extremely distinct, which resembles the snoring of a person asleep, or the tone of the bass string of a violin when struck with the finger. It sometimes also is similar to the cooing of a turtle, but may have a more acute character. It appears to arise from the narrowing of the bronchial tubes, caused by determination of blood to the mucous

membrane lining them, or from any other change in the form of those canals. It may perhaps arise from the thickening of the minute projections of the mucous membrane which are observed at the divisions of the large bronchial tubes, and called '*eperons*' by the French anatomists. The pressing of a tumour, or hepatization of the lung, will also produce it; and it not unfrequently occurs from inspissated mucus lining the bronchial tubes.

We must be careful not to confound this rale with the guttural sound produced during sleep; the first has its seat in the chest, and is not heard by the naked ear; the second, on the contrary, is solely derived from the manner in which the air inspired and expired strikes the velum of the palate. By means of the stethoscope, it is easy to perceive that it does not take place in the cavity of the chest.

The sonorous rale is the pathognomonic sign of acute bronchitis.

In pneumonia, accompanied by bronchitis, we have the sonorous and crepitating rales complicated. In the dry pulmonary catarrh, or asthma, the sonorous and hissing rales are met combined. The first varies little; the second is of

great mobility, disappearing for a greater or less time, in consequence of coughing, or without any perceptible cause; and then returning suddenly and with a different intensity. Sometimes both are constant, distinct, and accompanying the greatest part of the organ. The catarrh is then extensive and violent.

In the humid variety, the same phenomena may exist, but ordinarily they are complicated with a third, namely the mucous rale, which becomes entirely predominant after the acute stage is past, and thus characterises the disease.

PATHOLOGY OF PULMONARY CATARRH.

Thickening and redness of the mucous lining of the bronchial tubes, are the true pathological appearances of this disease; but we generally find when a patient dies with symptoms of this affection, that the tissue of the lung is more or less inflamed, or that traces of inflammation are met with in the pleuræ or pericardium.

The pathology of bronchitis has been so admirably described by M. Andral, in his late work, that I shall make no apology for giving it in his own words.

"Upon opening the bodies of individuals who have sunk under a disease, during which they were affected with a mild and recent bronchitis, we find a circumscribed portion of the mucous membrane of a red colour. This redness is observed most frequently at the termination of the trachea, and in the first divisions of the bronchial tubes. If the inflammation has been more severe, the redness is more extended, and occurs especially in the smaller ramifications. It often happens that the redness is exactly confined to a single lobe, which is most frequently the superior. This red colour sometimes appears under the form of a minute injection, occurring at once in the submucous cellular tissue, and in the mucous membrane itself. Sometimes vessels cannot be distinguished, and we only observe a number of little red points; in other instances, there is nothing perceived but an uniform redness. In some cases, this redness diminishes progressively from the larger to the smaller bronchial tubes, while in others the reverse takes place. Frequently

it only occurs here and there, under the form of bands or insulated patches, which constitute so many inflamed and circumscribed spaces, between which the mucous membrane is healthy; this form of inflammation is similar to that which is so frequently met with in the intestinal canal.

When the inflammation is chronic, the mucous membrane generally loses its lively redness, and presents a livid violet, or brownish tinge; but it is very remarkable, that in individuals who had long laboured under symptoms of inveterate chronic catarrh, accompanied by puriform expectoration, the mucous membrane has been found scarcely pink, or even perfectly white, throughout its whole extent. We must not, however, conclude, that in these cases there was no inflammation, or that it never existed, as we find the absence of redness in other organs, where the former presence of inflammation does not admit of a doubt; this takes place in the pleura, the mucous membrane of the intestinal canal, and that of the urinary system. In these different affections, we cannot doubt that an inflammatory action did exist; but, either on account of its long duration, or the general debility of the patient,

it would seem to have left no traces of its presence, but a change in the secretion proper to the affected part.

The inflammatory softening of the mucous membrane lining the bronchial tubes, is not so frequent as that of the alimentary canal. We have never found it so well marked that the membrane could be removed in a pulpy state; it is also rarely found in a state of ulceration, which is the reverse of what occurs in the gastro-intestinal membrane.

The frequency of ulcerations in the bronchial membrane, decreases from above downwards. It is remarkable that in a great number of cases these ulcerations only occur, when there is, at the same time, inflammation of the mucous membrane lining the minute bronchial divisions.

Thickening of the mucous membrane is one of the most common effects of chronic bronchitis; it is sometimes so considerable as to narrow or almost close up some of the bronchial tubes. Thickening does not always occur in the mucous membrane; the cartilaginous and fibrous tissues placed behind it, may also experience a more or less considerable hypertrophia, concurring power-

fully to produce the narrowing of the bronchial tube.*

There is yet another affection, the consequence of chronic catarrh, which was first described by M. Lænnec, and called by him *dilatation of the bronchial tubes.* It consists in a widening or dilatation of a bronchial tube, so that its diameter becomes greater than that of the trunk from which it arises; it is only met with in subjects who have died labouring under chronic catarrh. The dilatation is sometimes so great, as to allow the introduction of a goose quill, or even of the finger. The extremities of the bronchial tubes so dilated, terminate in culs-de-sacs, or cells, from the size of a millet seed to that of an almond. Their lining membrane, generally of a red or violet colour, is besides evidently thickened. The substance of the cartilaginous rings passes insensibly into it, and is changed into a fibrous tissue, which cannot be separated from the mucous membrane by dissection. This organic lesion may exist in all parts of the lung, but more generally occurs in the superior lobe. In most cases, it affects but a small number of

* See Clinique Médicale. Tome II.

the bronchial ramifications, but it sometimes occurs in the whole of one of the lobes. In this case, the dilatation, not only relatively but absolutely considered, is always greater in the smaller, than in the larger ramifications, and greater in these than in the trunks from which they arise. The common trunk of the bronchial tubes is rarely dilated to an evident degree, even when some of its subdivisions are so widened as almost to equal its own diameter. In this case the intermediate pulmonary tissue is flaccid, deprived of air, evidently compressed, and exactly in the same state that we find the lung when pushed towards the vertebral column by a serous or purulent effusion in the pleura.

This affection frequently arises from chronic catarrh, or from any other disease in which there are frequent and long continued fits of coughing; thus pertussis is a common cause of dilatation of the bronchial tubes.

The immediate or proximate cause of this organic lesion is still involved in obscurity. M. Beclard thought that it was somewhat analogous to the dilatation of the blood vessels;* but even

* See "Dictionnaire de Médicine," art. Bronches.

the opinion of this eminent pathologist must not convince us, without better proof than he has brought forward.

In the following case, the stethoscope indicated the existence of cavities in the tissue of the left lung, and inflammation of the bronchial membrane in the antero-superior part of the right pulmonary organ; a diagnosis perfectly verified by the dissection.

CASE V.*

A woman, twenty-six years old, was admitted into the hospital of La Charité, in the month of September, 1822. At the age of eighteen she was attacked with a cough, which continued ever since. During the first four years, this cough did not appear to have injured her health. About the age of twenty-two, she began to be slightly affected by dyspnœa, and had a copious expectoration of blood. From this period the cough became more frequent and painful, her strength diminished, emaciation followed, oppression increased; and during the two next years the hæ-

* Clinique Médicale.

moptysis frequently returned. When between the age of twenty-four and twenty-five, nature seemed to make an effort to cure the disease, or at least the above-mentioned affections made no progress; she had no return of hæmoptysis, and her strength improved a little. At the expiration of that time, the bloody expectoration re-appeared in great abundance, and continued for several weeks; it was followed by rapid sinking. On admission she was reduced to the most extreme degree of marasmus. By means of auscultation we discovered under the left clavicle, and posteriorly on the same side, in the inferior and superior spinous fossæ, a well-marked gurgling, being a certain sign of the existence of tubercular excavations in these points. On the right side, in the space comprised between the clavicle and breast, the respiratory murmur was changed in many points into a grave sonorous rale. In every other portion of this side the respiration was distinct and strong; percussion produced a dull sound under the left clavicle. The patient said, that from the beginning of what she termed *the cough*, she felt a constant and painful degree of heat to the right of the superior por-

tion of the sternum. She died in three weeks after her admission.

Dissection.—Vast excavations in the left lung, with grey hepatization of the surrounding pulmonary tissue. The right lung had no tubercles, and appeared healthy. In both lungs the bronchial tubes were red. Those of the superior part of the right lung presented the following peculiarities: the parietes of the principal bronchial tube, after its second or third division, were of a remarkable thickness, and its diameter was considerably diminished. This diminution was best appreciated by comparing the bronchial tubes in both lungs. Those of the left, though of the natural dimensions, were three or four times as great. Some of the smaller branches on the right side were observed to return to their accustomed calibre; and again to become thickened and narrowed.

Red patches in the stomach, and ulceration of the small intestine.

OF THE HISSING RALE.

This rale resembles a prolonged wheezing sound, and accompanies either the end or commencement of inspiration or expiration. It may be grave or acute, dull or sonorous. These varieties may be met with in different parts of the chest, or may occur together in the same point at greater or less intervals. This rale is sometimes of very short duration, and has been compared by M. Lænnec, to the cry of young birds, to the sound produced when two pieces of oiled marble are suddenly separated; or to that proceeding from the action of a small valve.

The hissing rale is owing to the presence of a scanty but viscid mucus, obstructing more or less completely the small bronchial ramifications, through which the air is obliged to pass, before it reaches the vesicles. When it is heard over a considerable portion of the lung, respiration is very laborious. It is during the existence of this rale that we observe the sputa presenting an arborescent appearance, resembling the form, calibre, and ramifications of the minute bronchial

tubes, from which they have been expelled by the efforts of coughing.

The principal affections in which the hissing rale is heard, are emphysema of the lungs and the chronic pituitous catarrh of M. Lænnec. In the acute species of catarrh it occurs complicated with the sonorous and mucous rales.

In emphysema the respiration is not heard over the affected part, while the chest sounds well or even louder than natural on percussion. A slight hissing rale is heard from time to time, at the points corresponding to the affected part.

PATHOLOGY OF EMPHYSEMA OF THE LUNG.

This affection has been described by M. Lænnec as consisting in a dilatation of the air vesicles. It seems to have escaped the researches of most medical authors. Different observers have nevertheless given some facts which relate to this disease. Graaf, Ruysch, Bonnet, Morgagni, Van

Swieten, and Stork, relate their finding vesicles full of air under the pleura, but these authors conceived they originated from the rupture of an air cell, and the subsequent infiltration of air into the interlobular cellular tissue. Dr. Baillie, in his Morbid Anatomy, has described the three appearances observed in what is commonly called Emphysema of the lung; namely, the increased volume of the organ, the dilatation of the air cells; and the vesicles formed by the extravasation of air under the pleura; but the term emphysema of the lung has been restricted by M. Lænnec to the dilatation of the air cells alone.

In this last affection, the size of the air cells is much increased; most of them equal or surpass that of a millet seed; and some even attain the size of a French bean. These last do not often rise above the surface of the lung; sometimes, however, they form slight eminences on it. So far, the air is confined to its proper receptacles, and the disease consists solely in a morbid distention of the air cells. When this distention is much increased, or takes place in a sudden manner, the air cells are ruptured in different points, and the surrounding cellular tissue of the lung becomes infiltrated with air, causing an affection

analogous to subcutaneous emphysema. Vesicles of an irregular form are then found on the surface of the lung, which can be easily displaced by pressing them with the finger. Their size varies from that of a pea to that of a nut, or even an egg. The bronchial ramifications are sometimes dilated in the parts of the lung where emphysema exists.

Emphysema may attack part only of one lung, in other cases it occupies the whole of it; and even both lungs at once may be affected.

Where emphysema exists to a high degree, and occupies the entire of the lung, the latter appears as if forced into the cavity of the thorax; and when this cavity is opened, in place of collapsing, it, as it were, escapes, and rises in some degree over the edge of the thoracic parietes. If, in this state, without removing the lungs, we press them between the fingers, their tissue appears more firm than natural, and it is more difficult to render them flaccid by pressure. If we put an emphysematous lung into a vessel full of water, it sinks much less than a healthy lung, and often remains on the surface of the liquid. Its tissue is also drier than in the state of health. When a single lung is affected, it is much more volu-

minous than the other; frequently to that degree as to push aside the heart and mediastinum. The cavity of the chest is also evidently dilated on the affected side.

The following is a well-marked case of emphysema of the lung, from the work of M. Lænnec. I selected it as showing the peculiar variable character of the hissing rale. It is also remarkable in another point of view, as the heart was found in a state of hypertrophia, of which no indications were observed by means of the stethoscope. This may have been owing to a small portion of lung overlapping the heart. It arises, in some cases, from a mal-conformation of the thorax; and frequently from œdema of its parietes.

CASE VI.

A man aged thirty-seven years, of a strong constitution, entered the hospital on the 25th of May, 1818, complaining of œdema of the lower extremities. From the age of three years he had been affected with an habitual cough, and mucous expectoration. Respiration short and laborious, but not sufficiently so to prevent him from fol-

lowing his usual occupations. Upon entering the hospital, he presented the following symptoms. Skin of a clay colour, with a shade of violet. Countenance presenting a stupid expression; lips blue; respiration short, and very laborious; cough strong, sonorous, and frequent, followed by a scanty expectoration of a colourless, thready, and spumous liquid; voice sonorous, and rather hoarse. The chest resounded very well over its whole extent; but the respiratory murmur was scarcely heard below the clavicles, although the patient made great efforts during inspiration, and raised the thorax considerably. Over the rest of the thorax it was inaudible, or rather could only be suspected at intervals than heard, and was then accompanied by a slight hissing rale.

The sternum was convex longitudinally, and the thorax in general of a cylindrical form. The impulse and sound of the heart were slight.

Diagnosis. General Emphysema of both lungs.

He died on the 19th of October, 1818, having returned to the hospital after leaving it twice. During the whole of his stay, the respiratory murmur was only heard in some variable points, and then very feebly. It was clearest, and most

frequently distinguished between the clavicles and third ribs.

The body was examined twenty-four hours after death. Skin of a brownish colour; thorax cylindrical; little emaciation.

The brain and its membranes were tolerably healthy; no effusion in the ventricles. The heart was twice its natural size; the left ventricle greatly enlarged, its parietes thickened, and its tissue red and firm. The right ventricle, of great size, was filled with black coagulated blood; the foramen ovale was closed.

The lungs had no adhesions, filling exactly the cavity of the thorax, and not collapsing upon the admission of the external air. Their surface was smooth, shining, and drier than in the state of health. Towards their superior part, and anterior borders, they presented transparent vesicles, the largest of which was equal in size to a nut, and formed by the pleura raised and distended by air. Their specific gravity was less by half than in the natural state; they floated on water, without sinking at all in it; on compression there was heard the displacement of an elastic fluid, rather than the natural pulmonary crepitation. After pressure, the parts remained

flabby. When the lung was cut, a slight hissing sound was heard, caused by the escape of the air. The pulmonary tissue was drier than in its natural state; but in some points situated towards the centre and root of the lung it was less emphysematous, and here there flowed from the incisions a small quantity of very frothy and sanguinolent serosity.

PHENOMENA OF THE VOICE.

Natural Phenomena.—These vary, first, according to the points which we examine; and secondly, according to the tone of the voice.

When a healthy man speaks or sings, his voice resounds in the interior of the chest, and produces through its whole extent a sort of trembling, or vibration, easily distinguished by the application of the hand.

If we apply the stethoscope to the thorax while the individual is speaking, we hear a confused resounding of the voice, the intensity of which varies in different points of the chest.

It is heard most distinctly in the axilla; on the back, between the internal border of the scapula and the spinal column; and in the antero-superior part of the chest, towards the angle formed by the union of the sternum and clavicle. In these points the voice seems stronger, and, as if it were closer to the ear of the observer. In the remaining parts of the chest, particularly the inferior and posterior regions, it appears weaker and more distant, and only produces a confused sound, in which nothing articulate can be distinguished. In

men whose voices are deep, the resounding is stronger, but dull, confused, and almost of equal intensity in all points; while in individuals with a high voice, as women and children, it is clear and very distinct.

Pathological Phenomena.—These are of four sorts, namely, *Bronchophonia*, *Pectoriloquism*, the *Metallic tinkling*, and *Egophonia*.

OF BRONCHOPHONIA.

This term is given to a vibratory sound of the voice, louder than natural, or occurring in a point where it is not heard in the state of health. There is nothing articulate in the sound; it is a confused noise, which barely seems to enter the bottom of the stethoscope, without traversing the tube to arrive at the ear of the observer. Induration of the pulmonary tissue, produced either by an inflammatory affection, or by a mass of crude tubercles, appears to be the cause of this phenomenon, by rendering the lung more fit for transmitting the murmur of the voice.

We obtain an accurate idea of this phenomenon, by applying the stethoscope on the point of the chest corresponding to the root of the lung,

while the individual is speaking. When it occurs in the case of extensive hepatization of the lung, it is always accompanied by the bronchial or tracheal respiration.

This symptom is sometimes of great importance, enabling us to institute a comparison between the two sides of the chest; and, from its co-existence with other phenomena observed by different methods of examination, leading to a more certain conclusion.

OF PECTORILOQUISM.

We say that a patient has pectoriloquism, when the voice distinctly articulate, seems to issue directly from the place where the stethoscope is applied, and to traverse the canal of that instrument.

Pectoriloquism is either perfect, imperfect, or doubtful. It is *perfect*, when the articulate and well-defined voice traverses the cylinder, and arrives at the ear with its natural, or an increased intensity of sound. It is *imperfect*, when the articulate voice reverberates strongly under the stethoscope, appearing to approach the ear, without

however traversing the entire tube. It is *doubtful* when the voice appears sharp and restrained, like that of ventriloquists; not traversing the tube, and approaching to mere bronchophonia. Imperfect and doubtful pectoriloquism can only be trusted to, as indicative of organic lesion, when they exist on one side only, or when they co-exist with other symptoms observed by examining the respiration.

The most perfect pectoriloquism may sometimes take on the characters of the imperfect, or even doubtful species, for a short time. It may disappear from time to time, becoming thus intermittent. This change shall be explained, after the exposition of the causes of pectoriloquism.

This phenomenon is owing to the presence of excavations in the lung, however produced, communicating freely with the bronchial tubes, and either in part or completely empty. Pectoriloquism may be met with in all parts of the chest; but it is most frequently observed in the axilla, the space between the clavicle and the trapezius, that immediately under the clavicle; and the infra and superior spinous fossæ. These all correspond to the superior part of the lung; and it is here that the excavations produced by the sof-

tening of tubercles are most frequently observed. Pectoriloquism varies with the sound of the voice, the size of the excavations, their form, and the density of their parietes, the adhesion of the two pleura over these cavities; and the facility or difficulty with which the air enters them.

The more acute the voice, the more evident is pectoriloquism; in persons with a deep voice, it is almost always imperfect, and sometimes doubtful. Aphonia does not cause it to disappear completely, and it often happens that we can distinguish better what the patient says by means of the stethoscope applied over the excavation, than with the naked ear at the same distance.

In order that pectoriloquism may be *perfect*, it is necessary that the excavation be only of a moderate size. In very large excavations, pectoriloquism is changed into a deep sound, analogous to that of the voice transmitted to some distance through a trumpet or cone of paper. Where, on the contrary, the cavities are very small, it is frequently *doubtful*, especially if the excavation is situated in the centre of the lung, and surrounded by parts still easily permeable to air.

The irregularity, or the direct communication

of a number of cavities with one another, causes pectoriloquism to appear somewhat stifled and confused; the voice appears badly articulated. The firmer and thinner the parietes of the excavations, the more perfect is pectoriloquism. When by a process of cicatrization, a fibro-cartilaginous membrane is formed over the entire surface of one of these cavities, the pectoriloquism acquires a metallic tone, sometimes so considerable as to hinder our accurate perception of the sounds.

An excavation situated at the surface of the lung, and whose thin parietes do not adhere to the costal pleura, but collapse during expiration, does not cause pectoriloquism. On the contrary, a superficial excavation with thin *adherent* walls gives so strong a pectoriloquism as to fatigue the ear.

This phenomenon is more evident in proportion as the cavity contains less fluid, because the bronchial communication is then generally free, permitting an easy access to the air. This communication, however, may be destroyed more or less completely, by the accumulation of the sputa in the bronchial tubes: this renders perfect pectoriloquism *doubtful*, and gives it that intermittent

character which is not unfrequently observed. It may be often remarked, when pectoriloquism is absent in a patient in whom we have observed it but the evening before, that the expectoration has been scanty, or almost entirely wanting.

True pectoriloquism is heard in the affection termed by M. Lænnec, Dilatation of the Bronchial tubes. Of this he has given a case (art. 149.) of his great work.*

A woman labouring for some years under habitual yellow expectoration, was evidently pectoriloquous on the right side above the third rib. Upon dissection, two bronchial tubes, dilated to three times their natural size, were found in the corresponding part of the lung, one of them terminated in a sort of cul-de-sac, large enough to contain a small nut.

M. Andral† has given a very instructive case of dilatation of the bronchial tubes giving rise to pectoriloquism.

A middle aged man entered the hospital of La Charité, labouring under the symptoms of pulmonary consumption. The respiratory murmur was scarcely heard on the left side of the

* De l'Auscultation Médiate. † Clinique Médicale.

chest, while anteriorly, on a level with the heart, and posteriorly, below the inferior angle of the scapula, evident pectoriloquism was observed. He sunk after remaining nearly two months in the hospital; the following is the account of the dissection in the words of M. Andral.

"The left lung generally crepitated but little; it however floated when plunged in water. In the superior lobe there existed a cavity large enough to contain a middle-sized nut, and filled with a fluid analogous to the matter of expectoration. A bronchial tube, as large as a writing pen, opened into it. Dissection soon convinced us that its parietes were continuous with those of the cavity itself, forming the same tissue. We found in both, the mucous membrane red and thickened, and the fibrous membrane with some traces of the cartilaginous rings. It was now very evident that what we had taken at first for a tuberculous excavation, was nothing but a considerable dilatation of a bronchial tube. In many points of the parietes of the dilated portion small orifices opened, which led into other bronchial tubes."

PATHOLOGY OF PHTHISIS.

It was long supposed that the cavities met with in the lungs were in every case the consequence of suppurative inflammation of the pulmonary tissue, but the labours of M. Bayle* have proved, that in a vast majority of the cases where excavations have been found in the lungs, they have originated from the processes of softening and evacuation, which a peculiar species of productions, named *tubercles*, undergo.

M. Lænnec has stated, that he thinks the existence of tubercles in the lung to be the cause, and to constitute the true anatomical character of phthisis.

A tuberculous excavation is essentially different from an ulcer, inasmuch as this last is understood to corrode the tissue in which it is formed, while the former arises from the spontaneous destruction of an accidental production, which has separated, and pressed the pulmonary tissue, but has not destroyed it, or increased at its expense.

* Recherches sur la Phthisie Pulmonaire.

Tubercles are first developed under the form of small semitransparent grains, of a light greyish colour, and from the size of a millet to that of a hemp-seed; in this state they are called miliary tubercles. These grains increase, become yellow and opaque, at first in the centre, and afterwards through their whole extent. Those nearest to one another unite and form masses of different sizes, which are of a pale yellow colour, opaque, and of a density similar to that of the most firm cheese; they are then named crude tubercles.

It is generally about this stage of the tubercular developement, that the surrounding pulmonary tissue, until then healthy, becomes indurated, grey, and semitransparent, from a new production of tuberculous matter in the first degree, which is infiltrated into its substance.

Sometimes, also, tuberculous masses of great size are formed by a similar infiltration or impregnation, without the previous developement of miliary tubercles. The pulmonary tissue, thus infiltrated, is dense, humid, completely impermeable to air; and when cut, the surface of the incisions is smooth and polished. According as these indurations pass into the state of crude

tubercles, there appear in their substance a great number of minute, opaque, yellow points, which multiply till they occur in almost every part of the indurated mass.

In whatever manner crude tubercles are formed, they terminate sooner or later by softening, and becoming liquid. This process commences towards the centre of each mass, which from day to day becomes softer and more humid, until the change reaches the circumference, and becomes complete.

In this state the tuberculous matter may present itself under two different forms. Sometimes it resembles a thick inodorous pus, more yellow than the crude tubercle; or it occurs separated into two parts, one very liquid, and more or less transparent and colourless, at least when it is not tinged with blood; the other opaque, and of the consistence of soft friable cheese. In this last state, which is frequently met with in scrofulous subjects, it often bears a strong resemblance to whey, in which small fragments of curd are floating.

When the tuberculous matter is completely softened, it opens for itself a passage into some of the neighbouring bronchial tubes.

It is extremely rare to find but one excavation in a lung thus affected. The cavities are most frequently surrounded by crude and miliary tubercles, which, softening successively, open into the principal excavation, and form anfractuosities which are continued by degrees to the surface of the lung.

Bands of condensed pulmonary tissue, generally infiltrated with tuberculous matter, often cross these excavations; they are thinnest at their middle, and bear some resemblance to the columnæ carneæ of the heart.

According as an excavation begins to empty itself, its parietes are covered with a sort of false membrane, which is thin and equal throughout, of a white colour, almost opaque; and so soft, that we can easily remove it by scraping with the scalpel. This membrane is generally complete, and lines the whole of the excavation. Sometimes, however, there is found in its place a thinner and less friable pseudo-membranous exudation, more transparent, and adhering with greater force to the parietes of the excavation, which it usually covers but partly; when it is found throughout, it is here and there of a greater thickness, appearing as if it were the product of

an exudation, which commenced in many different points at once.

It sometimes happens that neither of these false membranes occurs, and the parietes of the cavity are then formed of pulmonary tissue, generally indurated, red, and infiltrated with tuberculous matter in different stages of developement.

If the disease remains stationary for a long time, greyish white plates, of a texture analogous to that of cartilage, but a little softer, are developed behind the false membrane above described; they are semitransparent, and adhere strongly to the pulmonary tissue. These patches, or plates, as they increase and unite, completely line the excavation, and terminate by a continuity of substance with the bronchial tubes which open into it.

The above is the most common mode in which tubercles are developed, but it is not the only one. Two others exist, probably only varieties of the former, but whose characters are sufficiently marked to deserve notice.

In a lung, presenting tubercles in different stages of progress, we sometimes find small portions of pulmonary tissue infiltrated with a gelatinous matter, humid rather than liquid, transpa-

rent, semi-concrete, slightly grey, or sanguinolent. We can no longer distinguish the air cells in the parts thus infiltrated, but we may perceive a multitude of very minute, opaque, yellowish-white points, which are evidently formed by tuberculous matter in the second degree. The other mode of anomalous tubercular developement appears to occur without the precursory formation of the grey matter; at least, if this does take place, the passage of the first degree to the second is so rapid that it has not been perceived.

This variety appears under the following form: we find here and there tuberculous masses of a yellowish-white colour, much paler, and less distinct from the substance of the lung than the ordinary crude tubercle; they are irregular in their form, unlike the common tubercle. They appear to be the result of a kind of infiltration of tuberculous matter into the substance of the lung, while the round tubercles appear rather to push aside than penetrate the pulmonary tissue. These masses may be well termed tubercular infiltrations of the lung. They sometimes occupy a considerable portion of one lobe; but even when arriving at the surface of the lung, they do not

rise above it. They terminate by softening in the same manner as other tubercles.*

In the following case, two important signs were furnished by mediate auscultation, namely, pectoriloquism, and the metallic tinkling, to be described hereafter. The diagnosis from these indications was completely verified by the *post mortem* examination. Pectoriloquism indicated a cavity in the left lung; and the metallic sound, the presence of a fluid, which must have been in small quantity, as no fluctuation was heard on having recourse to the Hippocratic succussion. Cavities were also found in the right lung; but let it be observed, that they were completely filled with pus, and therefore incapable of affording either of the above signs.

CASE IX.

A woman, aged forty-six, was admitted into the hospital Necker, on the 29th of January, 1818. She was affected since her last delivery with an increasing cough, which commenced three

* See Lænnec.

months before. Being examined the day after her admission, she presented the following symptoms :—respiration short and quick, oppression, face pale, resonance diminished in the anterior and back part of left lung; stronger on the anterior part of the right one; pectoriloquism at the union of the sternum and left clavicle, less evident in the axilla of the same side.

On the 2d of February, the lips were livid; the belly soft and not painful; respiration short.

On the 3d, when the patient coughed, a sound resembling the fluctuation of a liquid was heard, by means of the cylinder on the left side; when she spoke, the metallic tinkling was heard at the same point; but succussion did not produce the sound of fluctuation. On account of these symptoms the following diagnosis was formed. *Extensive tubercular excavations in the middle of the left lung, containing a small quantity of very liquid tuberculous matter.*

There was nothing worth noticing during the following days; she died on the 8th.

The body was opened in twenty-four hours after death; face a little purple; slight emaciation of body and limbs.

The right lung presented, through its entire

extent, an innumerable quantity of tubercles of a yellowish-white colour, which varied from the size of a millet seed to that of a cherry kernel, or even a filbert. These last were evidently formed by the union of many small ones. Besides this great number of tubercles, the right lung presented here and there some cavities, the largest of which could contain a nut. These cavities were entirely filled with a puriform liquid, more consistent than that of an abscess, and their parietes were lined by a double membrane, the internal of which, soft, white, and opaque, adhered slightly to the external. The latter, white, semitransparent, and as if cartilaginous, adhered closely to the pulmonary tissue; it did not exist in every part, for on some points of the parietes, the pulmonary tissue, slightly red and granulated, was seen exposed under the inner membrane.

The left lung adhered closely to the pleura costalis and pericardium. Opened longitudinally it presented, near its anterior surface, and a little to the side, three cavities, one above the other, and communicating by means of two large apertures. Of these cavities the upper occupied the superior portion of the lung, corresponding with the union of the sternum and clavicle; it could

contain a pigeon's egg. The second was the largest, and could easily receive a hen's egg; finally, the lowest and smallest was placed about an inch above the lowest part of the lung, and could contain a nut; these cavities were lined by the two membranes already mentioned. They communicated with many bronchial tubes, and contained a liquid pus mixed with bubbles of air, which occupied at least the fourth part of the excavation. Besides these three large cavities, the left lung contained several smaller ones, together with many tubercles. It was cut into with more difficulty than the right lung, and crepitated in some parts only. Around the cavities the pulmonary tissue was of a reddish violet colour, dense, and not granulated.

OF THE METALLIC SOUND OR TINKLING.

When this phenomenon takes place, we hear, upon raising the patient, or causing him to cough, a remarkable sound of short duration, which is analogous to that produced by a drop of water falling into a deep vessel, a grain of sand into a

glass cup, or to that which we hear by striking a metallic or porcelain vessel with a pin. It seems as if a drop of fluid detached itself from the superior part of a cavity, and by falling into the mass of liquid at the bottom of the excavation, caused by its shock this peculiar sound.

This *metallic sound* is heard when the patient breathes, speaks, or coughs, but much more distinctly in the two last, than in the first of these actions. There are, however, some exceptions to this general rule. Coughing renders it so very distinct, that it is advisable to make the patient cough, in order to assure ourselves of the existence of this phenomenon in doubtful cases.

When it coexists with pectoriloquism, we hear it traversing the tube of the stethoscope along with the voice; when pectoriloquism does not exist, and we produce the phenomenon by means of the voice, a slight acute sound is heard vibrating in the interior of the chest, analogous to that produced by striking a metallic chord with the end of the finger.

As this peculiar sound depends on the vibration of the air, caused by respiration, the voice, or coughing, on the surface of a liquid partly filling an unnatural cavity in the chest, it can only

exist in two cases; first, where a serous or purulent effusion coexists with pneumothorax, arising from a fistulous opening into the cavity of the *pleura*; and secondly, where a large excavation, half filled with fluid pus, occurs in the substance of the lung.

In order that it shall happen in the first case, it is necessary that a fistulous opening be found between the cavity of the pleura and some of the bronchial tubes; thus it becomes a sign of this triple lesion. The distinctness of the sound is in proportion to the diameter of the fistulous opening, and the extent of the vibrations teaches us the space occupied by air; it is in general stronger as the quantity of air existing in the chest is greater; and hence we may conclude, when it is indistinct, that the liquid effusion is considerable, and vice versa.

When it arises from the vibrations of the voice, or from coughing, acting on the surface of puriform matter in a large excavation of the lung, it presents some important differences. Its indistinctness, and the small extent of its vibrations, teach us that it occurs in a very circumscribed space; it appears to enter the cylinder, and is combined with pectoriloquism, which, with the

other symptoms, enables us easily to distinguish *this* from the former case.

PATHOLOGY OF PNEUMO-THORAX.

Aëriform fluids, sometimes inodorous, at other times exhaling an odour of sulphuretted hydrogen, are now and then met with in the cavity of the pleura. Their quantity is often so considerable that the lung is forcibly pushed back towards its root, and even the thoracic parietes sensibly distended. The ribs are separated from one another; the diaphragm, pushed downwards into the abdominal cavity, forms there a considerable prominence when the gaseous effusion is on the left side. When it is on the right, the liver is pushed downwards so as to pass the edge of the false ribs.

The cases related by M. Itard * are those where pneumo-thorax was developed, in consequence of a latent pleurisy which accompanied phthisis pulmonalis, and following the absorption

* Dissertation sur la Pneumo-thorax. Paris, 1803.

of the greatest part of the effused fluid. In these cases it was probable that the developement of air was owing to the decomposition of the effused albuminous matter. This is not the only species of pneumo-thorax, Lænnec considers that arising from the softening of a tubercle, effecting a communication with the cavity of the pleura, as the most frequent in its occurrence.

Pneumo-thorax almost always occurs when a gangrenous eschar of the lung opens into the cavity of the pleura.

This affection often takes place from the decomposition of blood which has been effused into the pleura. It may also occur in consequence of a fall, or a violent blow on the chest, causing a rupture of the pleura and some of the air cells. It seems also probable, in cases of emphysema with rupture of the air cells, and consequent effusion under the pleura, that when this membrane is broken in its turn, pneumo-thorax will take place.

To conclude, there may occur an aëriform exhalation in the pleura, when there is no solution of continuity, or other visible alteration in this membrane, and where there is no other effusion into the cavity of the pleura. In cases where there

is an effusion both of air and liquid into the cavity of the pleura, we hear, upon suddenly and repeatedly shaking the trunk, a sound like that given by a bottle half full of water. In performing this method of examination, first practised by Hippocrates, it is not necessary that the shock shall be strong, a slight agitation is sufficient to assure us of the presence and quantity of liquid contained in the pleura. In order that the sound may be heard, it is a necessary condition that there shall exist at once both air and liquid in the pleura. If the lung occupy the superior portion where the effusion ceases, no sound will be heard; if the aëriform collection be too abundant, no results can be obtained. Certain proportions must exist between the two effusions. This sound cannot be confounded with that of the liquid contents of the stomach, as it is easy to recognise it with the cylinder at the spot where it is produced. The patient himself is often the first to mention it, as he hears it on the slightest motion. In these cases, percussion is of the greatest value in rendering our diagnosis more certain, for the sound is always clear in the superior part of the chest, and dull in the inferior; and

this character will vary with the position of the patient.

The next case affords a striking example of M. Lænnec's accurate diagnosis in a complicated affection. The patient had at first phthisis; a tubercular cavity opened into the pleura, caused pneumo-thorax, and pleurisy accompanied by effusion.

The presence of tubercles in the left lung was rendered probable by the dull sound on percussion, and the bronchial respiration. A cavity was also indicated by the pectoriloquism, which at this stage of the disease was *imperfect*, and the cause of this peculiarity was explained by the gurgling sound, proving that the cavity still contained much softened tuberculous matter. In course of time pectoriloquism became more distinct, as the cavity became more empty, and the metallic tinkling was now heard for the first time. This phenomenon, with the nullity of respiration, and increased sound on percussion, left no doubt as to the nature of the disease. The Hippocratic succussion proved the existence of a liquid in the cavity of the chest, while the increased pectoriloquism showed that the seat of this fluid was in the cavity of the pleura.

CASE X.

A woman aged 26, rather tall, of a weak constitution and lymphatic temperament, entered the hospital *Necker* in the month of January 1819. According to her own account, she had been affected with a cold for the last three months. During the last month she had lost her appetite, and became so weak as to be unable to work. Some of the lymphatic glands in the right axilla were swollen. On the day of her entrance, the chest resounded moderately in its whole extent, the sound appearing duller in the antero-superior left part. In this situation, imperfect pectoriloquism occurred, and the patient in breathing seemed to inspire the air contained in the stethoscope. Under the axilla on the same side, respiration was accompanied by a mucous rale, or gurgling sound, so distinct that it could be only attributed to the passage of air across softened tuberculous matter. The following diagnosis was consequently formed.

Tubercles in the lungs; a tubercular excavation at the upper part of the left lung.

On the 3d of March, she was again examined

with the same results. Pectoriloquism more distinct.

She had increasing dyspnœa, diarrhœa, the pulse weak and very frequent. On the 17th the nose was slightly violet, and the extremities appeared colder than the trunk. Upon applying the stethoscope above the third rib, a slight *metallic tinkling* was heard, which was more evident below the mamma. Respiration was not heard over the whole of the affected side, which, nevertheless, resounded much better than the right side, where the respiratory murmur was sufficiently distinct. The Hippocratic succussion enabled us to hear the fluctuation of the liquid. Pectoriloquism very distinct, from the left clavicle to the second rib, and also in the sub-spinous fossa of the same side.

In consequence of these observations, there was added to the preceding diagnosis, *Pleurisy and pneumo-thorax of the left side, produced by the opening of a tuberculous excavation into the pleura.*

The patient died in the night time.

Dissection.—At the moment the left side of the chest was penetrated by the scalpel, a large quantity of nearly inodorous air escaped with a hissing noise. The chest being opened, the left side

appeared half empty. The lung was pressed upwards and backwards, so as to have only the third of its natural volume. The surface of the pleura presented here and there a punctuated redness; its cavity containing a slightly yellowish transparent liquid mixed with some whitish fluids. The lung adhered closely to the costal pleura nearly over the whole extent of its superior lobe. On its external surface, immediately above this adhesion, and on a level with the middle part of the third rib, there was found an opening or ulceration about the size of the nail, covered with a thickish yellow mucus, across which bubbles of air escaped when slight pressure was made from above. This opening was the termination of a very short fistulous passage, capable of admitting the little finger, and communicating with a vast and nearly empty tuberculous excavation, which occupied a great part of the superior lobe of the lung.

OF EGOPHONIA.

This is a strong reverberation of the voice, which seems more acute than that of the patient, shrill, interrupted, and quivering like that of a goat, the tone of whose voice it much resembles.

This phenomenon may be produced over the whole extent of the chest, on one side only, or on both at once; but it rarely occurs that we do not find it within a circumscribed space, the limits of which are formed by the vertebral column, and the internal edge of the scapula; it also occurs at the inferior angle of this bone, and in a space, three fingers in width, which following the direction of the ribs, passes from the middle of the scapula to the sternum. Egophonia varies much in its force and extent, it is heard over a much greater space than pectoriloquism; it always appears to indicate the existence of a small quantity of liquid in the cavity of the pleura, or, according to M. Collin, the occurrence of thick pseudo-membranes yet in a soft state.

When the effusion above mentioned becomes too abundant, or is greatly diminished in quantity, the phenomenon ceases to exist. It is not heard when the effusion takes place rapidly so as to fill the cavity in a sudden manner. "I think," says M. Lænnec, "that egophonia is owing to the natural reverberation of the voice in the bronchial tubes, transmitted by the medium of a thin and trembling layer of effused fluid, and made more evident on account of the compression of the pulmonary tissue, which is consequently better adapted for the transmission of sound."

Many facts support this opinion; the points where egophonia is most frequently heard, are those which indicate the superior part of the effusion, and, of course, its thinnest portion; this takes place when the patient is lying on his back, or seated upright. If, on the contrary, we make him lie on his belly, it is either not heard at all, or at least very feebly in the space comprised between the scapula and spinal column, while it continues to be heard at the side. If we cause the patient to lie on the side opposite to that affected, egophonia becomes also less apparent.

The cessation of the phenomenon, when the

effusion is very abundant, and its return, when this abundance diminishes, confirm the opinion above mentioned; for, when the effusion becomes very considerable, the bronchial tubes themselves would be found compressed like the pulmonary tissue; and when diminished, they would necessarily resume their volume before the latter, on account of their greater elasticity.*

"It appears important," says M. Andral, "to observe that the word egophonia is only a generic term, under which, various modifications of the quivering sound, not resembling the voice of the goat, are comprehended. Frequently these different degrees of egophonia only occur by intervals, or are heard in the pronunciation of certain words. We have seen, for example, a patient in whom egophonia was only to be met with, (but then in a very distinct manner) when he pronounced the word *oui*.

"We can easily perceive that these numerous varieties may lead to frequent illusions, and that it is even possible to regard, as a pathologi-

* M. Lænnec at present conceives, that egophonia arises from the flattening of the bronchial ramifications, caused by the pressure of the effused fluid.

cal phenomenon, what in truth occurs in the state of health. But there is a sure way of avoiding this error; it is, that we shall never pronounce whether egophonia exists or not, until we have heard the voice on the side presumed to be healthy. It has frequently happened, after having believed that egophonia and other signs indicative of effusion existed, we have discovered our error from the examination of the opposite side." *

Egophonia may be looked upon as a rather favourable sign in pleurisy, inasmuch as it indicates that the effusion is not very considerable.

We should expect to find egophonia occurring at the same time in different parts of the chest, when several circumscribed pleurisies exist, and this is actually the case. Here the usefulness of the stethoscope must strike the most ignorant or prejudiced observer, as it points out the seat of the disease with the utmost certainty, and directs us in the application of our most powerful topical remedies.

* Clinique Médicale. Tome II. art. 77.

PATHOLOGY OF PLEURITIS.

Pleuritis, or pleurisy, is divided into the acute and chronic species, which, though not very dissimilar in their pathological characters, yet are sufficiently so to merit separate anatomical descriptions.

Of Acute Pleurisy.—This inflammatory affection, like that of all serous membranes, has for its anatomical character redness of the affected membrane. This redness is formed into points which are thinly scattered over the surface of the membrane, leaving between them intervals, in which we can still distinguish the natural colour of the pleura. The blood vessels which ramify on the surface of the affected membrane, are found redder and more apparent than in the natural state.

Inflammation of the pleura is generally accompanied by an effusion on its internal surface, which consists of two different materials; the one semi-concrete, known under the name of *false membrane;* the other very liquid, and called *serosity*, or sero-purulent effusion.

The false membranes are formed by a yellowish

white, slightly semitransparent matter, the consistence of which is in some cases hardly greater than that of pus, but generally equal to that of the white of an egg boiled, or the buffy coat of blood, to which last it bears a strong resemblance. This matter, extended like a network over the inflamed part, when the pleurisy is general, follows all the folds of the pleura, as well pulmonary as costal, forming within it a complete double lining. In cases where the inflammation is confined to the pulmonary or costal pleura, the false membrane only covers the affected part.

It frequently happens, where the inflammation has been general, that those portions of the false membranes which cover the lung and costal pleura, unite by means of slips of the same nature, which pass from the one to the other, traversing the serous effusion in the sac formed by the pseudo-membranous exudation. In this state the false membranes adhere but slightly to the pleura, so that they can be scraped off by the handle of a scalpel.

The usual thickness of the false membranes varies from half a line to two lines. It is sometimes, however, thicker in certain points, espe-

cially at the inferior part of the lung, and corresponding surface of the diaphragm.

Sometimes, and more particularly when the serous effusion is abundant, the false membranes are either wholly or in part detached from the pleura, and float in the effused serum. It even happens, that we find in the liquid, masses of concrete albuminous exudation of considerable size, whose globular form would seem to show that they had never been adherent to the pleura: this, however, appears difficult of conception. It is probable that these masses were formed in the angular folds which the cavity of the pleura presents towards the root of the lung, and the attachment of the diaphragm; and, by subsequent floating in the effused liquid, became rounded by their mutual attrition.

The serous effusion which generally accompanies the formation of false membrane, is usually of a light yellow or lemon colour; its transparency is injured by small portions of pseudo-membranous exudation; and in this state it has a strong resemblance to whey. In other cases, the serosity is of a deep yellow colour, and is sometimes even completely sanguinolent. In some instances, we find a pseudo-membranous exudation

uniting the contiguous surfaces of the pleuræ, without serous effusion. This would appear to happen frequently, were we to enumerate those cases where the absorption of the serum is the first effort of natural cure. The case which is to be noticed, consists in an exudation of white inodorous matter, consequent upon a slight and partial pleurisy, which has been complicated with some other severe and fatal disease. When this exudation is recent, we can separate the adhering parts, while some of it remains on the membrane affected.

In slight and partial inflammations of the lung, we sometimes find the pleura pulmonalis corresponding with the affected part, inflamed and covered to a small extent by a false membrane, which, according to the time of its formation, is yellow, opaque, and adhering slightly to the contiguous membrane; or firm, semi-transparent, reddened by a great number of minute vessels, and already divided into membranous layers. In some cases no serous effusion can be found, and in these instances it sometimes happens that neither the stethoscope nor percussion gives any sign of effusion during life. The same phenomena frequently occur in phthisical patients.

These false membranes gradually tend to convert themselves into a true serous tissue, analogous to that of the pleura. This conversion takes place in the following manner. The serous effusion is absorbed, the compressed lung expands, while the false membranes, now in apposition, unite into a single mass, which soon divides itself into thick and opaque layers, separated by a little serosity. It is at this time that the rudiments of blood vessels are first perceived. In a short time the pseudo-membranous layers become thinner and less opaque; blood vessels are seen to ramify through their substance; they become completely transparent, and as thin as plates of cellular tissue; and their vessels are quite similar to those which ramify on the internal surface of the pleura. But this newly formed tissue is still much softer than natural cellular tissue; and it is only at the end of some time that these layers assume the consistence or character of cellular, or rather serous tissue. These layers never occur alone, they are always continuous, and folded upon one another, so that they present, like the pleura itself, (to which they adhere by their extremities,) an exhalent surface, polished and lubricated by a slight humidity; and an adherent surface, by

which they are united, and on which their blood-vessels ramify.

The direction of these layers is in general perpendicular to that of the pleura.

If the effusion in pleurisy be very considerable, the lung from compression becomes flabby, and ceases to crepitate; its vessels are without blood; its bronchial tubes, with the exception of the large trunks, are evidently diminished in calibre; but we can still recognise its texture.

It bears no resemblance to the state of sanguineous infiltration which the lung presents in the first stage of pneumonia; and if we blow into the bronchial tubes, the pulmonary tissue is more or less perfectly developed.

Sometimes, however, portions of the lung are met with of a red colour, similar to that of muscle, and whose texture is so homogeneous that no trace of air cells can be perceived in it. Incisions made into it present a smooth and polished surface, which has nothing of the granulated appearance of pulmonary tissue, inflamed to the second or third degree. The small quantity of serum which exudes, is scarcely sanguinolent, and not at all frothy, which establishes a difference between this affection and pneumonia in the first

degree. This appearance is met with towards the central, inferior, and posterior parts of the pulmonary organ, in cases where the effusion had not been considerable, and where the superior part of the lung was still permeable to air. This state of the lung is termed carnification.

In the annexed case, the progress, diminution, and disappearance of the pleuritic effusion were pointed out by the stethoscope, in the most satisfactory manner. It was mentioned before, that egophonia only occurs when there is but a small quantity of liquid effused between the pleura; accordingly, it was not present when the patient entered the hospital, as the disease had then continued for some days, and the effusion was already considerable. This was proved by the dullness of sound on percussion, and absence of the respiratory murmur. But as his recovery made progress, egophonia became evident; with its diminution, the respiratory murmur increased until the egophonia totally disappeared, and convalescence ensued.

CASE XI.

A servant, aged 24, of a weak constitution, was seized, on the 16th of March, 1822, with a pain of the side, below the left breast, for which he could assign no cause. This pain continued for some days, but he paid no attention to it, and continued to work at his usual occupations till the 22d, when it became more severe, with a dry cough and oppression. Next day he entered the hospital, and was immediately bled.

24th. Face pale, expressive of great anxiety; inspirations short and frequent; oppression; dry cough. Pain below the left breast, which is increased by percussion, intercostal pressure, cough, and the respiratory motion.

The sound on percussion is dull on the left side, *laterally and posteriorly.* Respiratory murmur inaudible in these situations. Anteriorly it was heard feebly, but everywhere else very distinct. No egophonia. These symptoms announced the existence of an effusion in the left pleura, which, in fact, had commenced on the 22d, and was now so considerable that egophonia could not be perceived. The patient lay on the right

side. Pulse frequent. Tongue white. General sweating. Constipation. He was bled and leeched. Blood not buffy. Syncope during the operation.

25th. Pain of side has completely disappeared. He lies on his back. Other symptoms as before. He was bled to eight ounces, and on the 26th a large blister was applied over the left side.

27th. Respiration less laborious. He thinks himself better. Egophonia is heard for the first time, on a level with the inferior angle of the scapula. A remarkable quantity of serosity flowed from the blistered surface. Sweating abundant in the evening.

From the 28th to the 4th of April, the egophonia continued; the dull sound on percussion diminished, and the respiratory murmur began to be heard; but still much more feeble than on the right side. Respiration less laborious; pulse much less frequent; sweatings each evening.

On the 4th of April, the pulse was without frequency. A fourth of the usual hospital allowance was now granted for the first time.

5th. Respiration more laborious. Pulse again frequent. The allowance was discontinued.

6th. Symptoms as on the 4th.

On the following days the sweating ceased. Strength re-established. Slight cough, and little oppression. After the 12th of April, egophonia was no longer heard; still, however, the respiratory murmur was weaker on the left side. From the 20th, respiration was heard equally on both sides. Dismissed on the 28th.

CHRONIC PLEURITIS.

In this affection, the pleura is found redder than in the former state, the effusion is more abundant, and not so limpid, often containing such a quantity of albuminous flocks as to appear completely puriform. After death we find a great quantity of these fragments in the lower parts of the chest, forming a sort of gradation between the serous effusion and the false membranes. The effusion has generally a nauseous smell, more disagreeable than that of healthy pus.

In chronic pleurisy there is no tendency to a natural cure by absorption of the fluid and conversion of the false membranes into cellular tis-

sue.* The affected side becomes more voluminous than the other. The lung, pressed towards the mediastinum and vertebral column, by the pseudo-membranous exudation, is sometimes reduced so much in volume that it is only six lines in thickness. Its tissue is dense and flabby, like a piece of skin; it no longer crepitates under the hand; it is paler than natural, sometimes even grey and totally without blood. We may still, however, recognise the cellular texture, though in a few cases it presents some points of carnification.

Another variety of this affection exists; it is when acute pleurisy becomes chronic from any cause which prevents the speedy absorption of the effused fluid, and the conversion of the false membranes into cellular tissue; this generally happens in cachectic habits.†

M. Lænnec has first described with accuracy, a remarkable termination of chronic pleurisy, or

* It may be doubted whether the above opinion of M. Lænnec is to be admitted to its fullest extent. Several cases of chronic pleurisy have occurred in Edinburgh, where the false membranes were found in a state of complete organization.

† Lænnec.

as he says, of acute pleurisy become chronic; which consists in a more or less evident contraction of one side of the chest, giving to the patient a crooked or bent appearance. On the side towards which they are bent, the chest is evidently narrower, and when measured by a cord, more than an inch of difference is found between this and the healthy side; were we to judge by the eye, this difference would appear much greater. There is a similar diminution from above downwards; the shoulder is lower; the ribs brought nearer to one another; and the muscles, especially the pectoralis major, are reduced to half their natural size. The spine generally continues perpendicular. In these cases the sound on percussion is dull; but instances of slight contraction are not uncommon, where the diminution of sound has been but trifling.

In cases of chronic pleurisy, or of acute pleurisy become chronic, where the sero-purulent effusion has existed for a long time, the false membranes covering the lung and pleura acquire a kind of induration, and become somewhat similar to lard; they cannot be now converted into cellular tissue. When, at length, absorption of the fluid takes place, the lung, everywhere covered

by a thick false membrane, cannot dilate so as to follow the absorption of the effused fluid; the ribs then approach to one another, and the chest becomes contracted. When the absorption is perfect, the pseudo-membranous exudations on the costal and pulmonary pleura coming into contact, form a close adhesion; and, in the course of time, become a fibrous or fibro-cartilaginous membrane, presenting three distinct layers; of which the two exterior are white, opaque, and almost entirely fibrous; while the centre one is semi-transparent, bearing a perfect resemblance to the central and most transparent parts of the inter-vertebral cartilages. These membranes vary in thickness from two to five lines, and are conceived by M. Lænnec to arise from a secondary action, taking place at an advanced period of their organization, and causing the gelatinous and semi-transparent exudation, similar to that which takes place in the re-union of fractures.

These membranes are not to be confounded with the fibro-cartilaginous incrustations, which sometimes occur adherent to the pleura.*

* Dictionnaire des Sciences Médicales. Art. Cartilages Accidentels.

In these cases of contraction, the absence of the respiratory murmur, and the dull sound on percussion, are not to be attributed to the thickness of the accidental membrane, but to the collapsed state of the lung, which (in subjects presenting a great contraction) has been found reduced to the state of carnification.

Cases of pleurisy, accompanied by the formation of the fibro-cartilaginous membranes, sometimes occur, where all the symptoms are so extremely obscure, that the disease may be well termed *latent.* The pleuritic pain is seldom felt, lasts but for a short time, and is so trifling, that the patient feels no inconvenience from it. There is but little difficulty of respiration, and a slight dry cough. In persons subject to asthma, and attacks of catarrh, there is, however, oppression and a more or less abundant expectoration; but these symptoms resemble an attack of asthma or catarrh, rather than one of pleuritis. In many cases the evident symptoms are such as never to lead to the true seat of the disease. Languor, debility, want of appetite, and a somewhat feeble pulse, are often all that are observed. The cough is so trifling that neither the patient nor physician pays any attention to it.

In these cases nothing can be learned without the aid of the stethoscope and percussion. By the latter, we cannot distinguish whether the dullness of sound depends on a pleuritic effusion, or an inflammation of the lung; and if the disease is confined to the lower part of the right lung, it teaches us little or nothing. By the application of the stethoscope every thing is cleared up; and we learn from the absence of the respiratory murmur, except at the root of the lung, that an effusion has taken place into the cavity of the pleura.

OF THE MEASUREMENT OF THE THORAX.

By the measurement of the thorax, we compare the developement of one side with that of the other, and by this examination learn the comparative contraction or dilatation of either.

Dilatation takes place in cases of chronic pleurisy, where there is no tendency to the absorption of the effused fluid. In these cases, the affected side appears to the sight much larger than

the opposite one; the chest appears inflated, the intercostal spaces are on a level with the ribs; and the sound on percussion is completely dull. This state constitutes what has been termed empyema. Dilatation also occurs in pneumo-thorax and emphysema; but in these cases the sound on percussion is increased.

We must not trust to measurement alone as a means of diagnosis, as many individuals have the right side a little more developed than the left, without this being the consequence of any previous disease. Others, from the effects of early rachitis, present this peculiar conformation, or it may be, a *contraction* of the thorax. These circumstances should make us inquire accurately into the previous history of the patient.

In proceeding to examine the thorax by measurement, the patient should be made to sit upright, with his arms in a dependant posture, or joined over the head; but they must be always in the same relative position, for the state of muscular relaxation or contraction causes an evident difference in the measurement. The semi-circumference of the chest is to be taken by a string, from the spinous processes to the middle of the sternum; and then turning the string without mov-

ing its extremity from the spinous process, we are to measure the opposite side in the same manner.

The patient is to be stripped of all clothing on the thorax, and the operator should stand behind him.

OF THE HEART.

In this division of my subject, I shall discuss the phenomena of the heart in the same manner as I have done those of respiration and of voice, though in this case, the plan which I have laid down is not so easily followed, owing to the complications of disease which so frequently occur in the circulatory organ, and which often give rise to great difficulty in the diagnosis. Before the discovery of auscultation this difficulty was extreme; and although, in these formidable diseases, we cannot in every case come to an *absolutely* certain conclusion by means of the stethoscope, still it is of infinite assistance to us, and, in the hands of an experienced observer, will lead to conclusions unattainable without its aid.

In the examination of the heart by means of the stethoscope, we must be assured that the patient is in the calmest possible state; that he shall not have taken any exercise for some hours previously, nor indulged lately in the use of wine, or other spirituous liquors. He should be ex-

amined before his usual time of meals: for in many patients, especially those afflicted with diseases of the digestive organs, the action of the heart is either greatly increased after a meal, or may become so irregular as to simulate disease.

During the application of the stethoscope over the region of the heart, it will be necessary at the same time that the operator shall feel the pulse, as he is thus better enabled to judge of the phenomena which may be observed. It is frequently requisite to close the opposite ear with the finger; but this observation may apply to almost every instance where the stethoscope is used.

PHENOMENA OF THE HEART.

The phenomena arising from the action of the heart, may be divided into two great classes, namely, the *natural* and *pathological*. We shall first treat of the natural phenomena. These are, the extent of the pulsations of the heart, their stroke or impulse, the sound produced by them, and their *rhythme*.

Extent of the Pulsations.—In a healthy man whose heart is well proportioned, the pulsations are only heard between the fifth and seventh ribs on the left side, and under the inferior part of the sternum. The motions of the left cavities are heard particularly in the first, those of the right in the second situation. When the sternum is short, the pulsations may be heard in the epigastrium.

In fat subjects, in whom the pulsations of the heart cannot be felt with the hand, the space in which we can hear them by means of the stethoscope is sometimes limited to a surface of not more than a square inch.

In meagre persons, on the contrary, whose chests are ill developed, we distinguish the pulsations over three-fourths of the sternum from below upwards, sometimes even over the whole of this bone; over the superior part of the chest; and even under the right clavicle. In these cases, when the pulsation is less under the clavicles than in the præcordial region, we may conclude that the heart is in good proportion.

The shock or impulse.—By the impulse, is meant the feeling of elevation or percussion which is given by the pulsation of the heart. It is distinct

under the stethoscope, when the hand applied over the præcordial region can feel nothing. In a healthy man, especially if he is moderately fat, it is very little marked. We can distinguish it generally in the præcordial region, and the inferior half of the sternum, and always with greater force between the cartilages of the fifth and seventh ribs, the point corresponding to the apex of the heart. Its force varies *ad infinitum* according to the constitution of the subject. Custom teaches us to distinguish when this force is greater or less than in the state of health.

The Sound.—In the state of health, the alternate contractions of the different parts of the heart give rise to sounds, easily perceivable by the stethoscope, whatever may be the size and force of the circulatory organ.

Each pulsation of the heart corresponds to two successive sounds; the one, clear, distinct, and analogous to that produced by the valve of a bellows, corresponds to the systole of the auricles; the other, more dull and prolonged, coincides with the arterial pulsation, and the feeling of impulse mentioned above. It is produced by the contraction of the ventricles.

The sound of the right cavities is heard in the

inferior part of the sternum, that of the left between the fifth and sixth costal cartilages. It is always stronger in the præcordial region than in the other parts of the chest, where it may be distinct in subjects in whom the parietes of the heart are thin.

In these latter cases, the sound of the auricles is more distinct under the clavicles than that of the ventricles, which does not occur at the præcordial region.

In individuals in whom the anterior edges of the lungs are prolonged before the pericardium, the sound of the auricles is more obscure than that of the ventricles. In some cases the sound is no longer distinct.

The Rhythme.—By this term we understand the order in which the different parts of the heart contract, and the respective duration and succession of these contractions to one another. When the finger is applied to the pulse of a healthy man at the moment of its diastole, the ear applied to the stethoscope is slightly raised by a motion of the heart synchronous with that of the artery, while at the same time there is a dull sound; this indicates the contraction of the ventricles. Immediately after, and without any inter-

val, a sound more distinct, and of shorter duration, announces the contraction of the auricle: no motion sensible to the ear accompanies this sound. An interval of short but well-marked repose succeeds, after which a new contraction of the heart is heard.

The respective durations of the contractions of the auricles and ventricles appear to be pretty exactly determined in the following manner. Of the whole time in which a complete contraction and interval of repose takes place, from a third to a fourth is taken up by the systole of the auricles, a little less than a fourth by absolute repose, and the remainder by the contraction of the ventricles. These relations exist whatever may be the velocity or frequency of the motions, when the organ is healthy, and in good proportion.

PATHOLOGICAL PHENOMENA OF THE HEART.

The pathological phenomena may be divided into those which relate to the extent in which the pulsations of the heart can be perceived, to

the force of the pulsation, and to the nature and intensity of the sound thus produced.

The extent of pulsation may either pass its usual limits, or be confined to an unusually small surface.

Auscultation teaches us that the following is the order in which the augmentation of extent usually proceeds; it first occurs over the whole anterior part of the left side; secondly, over the same space on the right side; thirdly, over the left posterior part of the chest; and fourthly, (but which rarely occurs) over the right posterior part. The intensity of sound diminishes also in the above degree.

The possibility of hearing the pulsations of the heart, in these different regions, generally indicates a state of debility of that organ, as a thinning of its parietes, or passive dilatation of some of its cavities.

It may also arise from causes foreign to the state of the heart, and whose action is either temporary or permanent; such as emaciation, contraction of the chest, induration of the lung, the existence of excavations with firm parietes, pneumo-thorax, pleurisy, nervous agitation, &c.

OF DILATATION OF THE HEART.

In this affection, the sound of the pulsations is clearer than natural in the præcordial region. The ventricular contraction is distinct and sonorous; the extent in which we can hear the pulsations is increased, while the impulse is trifling.

This disease may affect both ventricles; it is however more frequently met with in the right than the left. The part where the sharp distinct sound is heard points out the cavity affected; thus when it is heard between the fifth and seventh ribs on the left side corresponding to the ventricular contraction, it forms the pathognomonic sign of dilatation of the left ventricle. The same sound heard under the sternum, or between the cartilages of the fifth and seventh ribs on the right side, indicates the dilatation of the right ventricle.

PATHOLOGY.

In this affection, denominated passive aneurism by Corvisart, the cavity of the ventricles is in-

creased in size, while their parietes become thin; this thinning may be so great that the left ventricle shall have only two lines in thickness at its base, and half a line at its apex. The muscular substance is softened, sometimes so much so as to be easily broken between the fingers; the colour is sometimes deeper than in the healthy state, sometimes paler, and almost yellow. The columnæ carneæ are removed from one another, and the inter-ventricular septum is diminished in thickness and consistence.

The increase of the dilated cavities is more in the direction of their diameter than of their length.

The following case is illustrative of dilatation of the heart with a thinning of its parietes; an instance of M. Corvisart's Passive aneurism.

CASE XII.*

A man of a lymphatic temperament, aged 31, entered the hospital Cochin, on the 30th July 1822, stating that for the last six months, he had been several times attacked with severe colds,

* Bertin, Traité des Maladies du Cœur. Paris, 1824.

accompanied by hæmoptysis. He had now a cough, with abundant expectoration of a thick greenish mucus, not streaked with blood. Dyspnœa on the slightest exertion. Pectoriloquism over almost the whole right side of the chest, with a gurgling rale. Impulse of the heart very feeble, the sound of the ventricles was remarkably clear, almost similar to that obtained by striking on a tambourine, it was heard even at the posterior part of the chest, and only differed from that of the auricles, in being a little more prolonged; pulse small, feeble, and frequent.—*Diagnosis, dilatation of the ventricles, with thinning of their parietes.*

He died on the 17th of August, and the body was opened eighteen hours after death.

Heart enlarged, its parietes soft, flabby, and thin. The right ventricle was not much enlarged, but the left greatly increased in size; and this dilatation must have taken place at the expense of the muscular substance, as the thickness of the left ventricle was hardly greater than that of the right. The auricles were not much altered either in size or thickness; their valves were of a violet-reddish colour. The right lung presented many tubercular excavations, and was

covered by a false membrane of considerable thickness towards the superior part. The left lung posteriorly, was infiltrated with serum, and contained miliary tubercles, with a few tubercular excavations.

OF DILATATION WITH HYPERTROPHIA.

This alteration, which constitutes the active aneurism of Corvisart, is detected by the strong and extended pulsation in the region of the heart, which appears to repel the hand with force; by the hardness and volume of the arterial pulsations, which may be compared to a column of mercury striking the finger; and which are evident to the sight in many parts of the body. Percussion on the region of the heart gives a dull sound. The ear, or the stethoscope being applied over the heart, receives a strong impulse at each contraction of the ventricles, while a distinct sound is heard. The auricular contractions are sonorous; and the pulsations are heard over a great extent, while their rhythme is rarely altered.

PATHOLOGY.

Dilatation with hypertrophia may exist in one or in both ventricles. It is in the last case that the heart increases so much in volume. This augmentation is owing to the thickening of the parietes of the ventricles, and the proportional increase in size of these cavities. The muscular substance of the ventricles is firmer than natural; the apex of the heart becomes blunter. The auricles are sometimes found affected, but rarely without complication of disease in the heart.

The next case is one of M. Corvisart's *Active Aneurism*, or dilatation with hypertrophia. The impulse of the heart indicated hypertrophia; and the fulness of the pulse, that the cavity of the ventricle was not diminished.

The case is remarkable for its rapidly fatal termination.

CASE XIII.*

A man aged 22 years, of the sanguineous temperament, entered the hospital on the 12th of

* Bertin, *Maladies du Cœur.*

January, 1818, presenting symptoms of acute rheumatism. He also complained of a pain in the inferior part of the left side of the chest. Pulse strong, full, and vibrating; face pale; abundant sweating; tongue white and moist; abdomen tense, and painful on pressure. On the second day the rheumatic pains were increased; respiration difficult; tongue red at its edges; much thirst. He had a fit of shivering, which lasted nearly three hours, followed by a violent heat, and copious diaphoresis; the pulsations of the heart were stronger, and the vibration of the pulse more distinct. He remained in the same state until the fifth day, when the symptoms were a little diminished, but on the sixth the rheumatic pains returned. On the eighth day they diminished; but the pulsations of the heart increased in force. Until the 8th of February, he was alternately better and worse. During this time, tumultuous palpitations supervened, on the 8th he had hæmoptysis, and on the 9th sunk in a comatose state.

Dissection.—The lungs were engorged with blood. The left lung was pushed backwards towards the superior part of the chest. The pericardium contained a yellowish serum. The

heart was greatly enlarged. The parietes of the left ventricle, towards its base, were more than an inch thick, the hypertrophia diminishing towards its apex, where it was still very evident. The columnæ carneæ were increased in size, and the cavity was more than doubled. Nothing unusual was seen in the left auricle, or in its valves. The parietes of the right ventricle were thinner than natural; but its capacity was not altered. Right auricle natural. The calibre of the aorta was unusually small.

We not unfrequently meet with dilatation of one ventricle, and hypertrophia of the other; but this disease is not so common as the preceding. Its symptoms are composed of those of each affection, that one predominating which is most severe. M. Lænnec reckons the following combinations of this kind which may occur. 1st, Active aneurism of the left, with passive of the right ventricle. 2d, Active aneurism of the left, with simple hypertrophia of the right ventricle. 3d, Active aneurism of the right, with passive of the left. 4th, Simple hypertrophia of the right, with passive aneurism of the left ventricle.

Dilatation of the auricles is a case rarely met with, especially when we consider the comparative frequency of a similar affection of the ventricles. It is sometimes found to occur in patients suffering under hypertrophia, or dilatation of the ventricles; but most frequently this does not occur. More rarely the auricles are found dilated, while the ventricles remain in their natural state.

Dilatation of the auricles may depend on two different causes; first, upon an augmentation of their cavities, which takes place during life, and depends on hypertrophia of one of the ventricles, on ossification, or thickening of the auriculo-ventricular valves. Secondly, upon an apparent increase of size, which takes place during the last moments of life, from the accumulation of blood in the auricles, which become distended on account of the elasticity of their tissue, but return to their original dimensions where the distending cause is removed. In this case they are thin, and allow the colour of the blood to be seen through many points of their surface; while, in the former, there is generally some thickening of their parietes, and, upon being emptied through their own vessels, the auricles do not regain

their original dimensions, but remain permanently enlarged.

The signs of the auricular dilatation, obtained by means of the stethoscope, may be confounded with those of the alterations of the heart, to which the dilatation is owing. Thus, when the left auricle is affected, the signs obtained may be confounded with those of ossification of the mitral valve; and dilatation of the right auricle is difficult to be distinguished from hypertrophia of the ventricle on the same side. Nevertheless, it may be said, that whenever the auricles are dilated, the sound of their contractions loses the clear and distinct character peculiar to it in the state of health; becomes duller, and analogous to that produced by air suddenly issuing from a bellows.

The diminution of extent in which the pulsations of the heart can be heard, is generally indicative of a thickening of the parietes of this organ, accompanied by diminution of its capacity. It occurs in softening of the heart; but most commonly in pure hypertrophia.

OF HYPERTROPHIA.

When the left ventricle is in a state of hypertrophia, its contraction gives a stronger impulse, and duller sound than in the natural state. The sound is prolonged in proportion to the degree of hypertrophia; and the contraction of the auricle is very indistinct. The pulsations of the heart are heard over a small extent, sometimes only between the cartilages of the fifth and seventh ribs.

When the right ventricle is affected, the sound of its contractions is the same as in the former case, except that it is not quite so dull; the impulse is stronger at the inferior part of the sternum than between the cartilages of the fifth and seventh ribs on the left side, which is the contrary of what happens when the left ventricle is diseased.

When hypertrophia occurs in both ventricles, the symptoms met with are composed of those resulting from the affection of each, but generally those of the right side are predominant.

PATHOLOGY.*

When the left ventricle is affected with hypertrophia, its parietes become greatly thickened, which morbid alteration diminishes from the base to the apex. The columnæ carneæ, and the inter-ventricular septum, partake likewise of the disease. The muscular substance becomes firmer and redder than natural. The cavity of the ventricle appears to diminish in proportion as its parietes are thickened; sometimes so much so as to be hardly capable of containing an almond. The right ventricle is smaller as the hypertrophia of the left is more developed; it is flattened in the direction of the inter-ventricular septum, and does not descend to the apex of the heart.

Hypertrophia of the right ventricle differs from that of the left, in being more uniform, as the thickening is nearly the same in every point, except about the tricuspid valve, and the origin of

* M. Bertin describes three species of hypertrophia. The first he calls simple, where there is merely thickening, without alteration in the capacity of the affected part. The second is the active aneurism of Corvisart; and in the third, the cavity is diminished in proportion as its parietes are thickened. Thus, he says, we have *simple*, *excentric*, and *concentric* hypertrophia.

the pulmonary artery. The augmentation of the columnæ carneæ, and the great firmness of the muscular substance are very remarkable. The thickness of the parietes is never more than from four to five lines.

The following is a remarkable case of hypertrophia, with diminution of the ventricular cavities. The right auricle was increased in capacity, probably arising from the state of the right ventricle. The increased impulse showed the hypertrophia; and the character of the pulse, that diminution of the left ventricular cavity had taken place.

CASE XIV. *

A woman, aged fifty-one, during her youth had been very liable to attacks of catarrh; she had almost always a dry cough, and a fixed deep seated pain at the superior part of the sternum on the left side. She entered the hospital on the 25th of March, 1814, with the following symptoms. Face slightly swollen, lips pale, and deep-seated pain, accompanied with a sense of weight

* Bertin.

in the præcordial region. The beatings of the heart were irregular and tumultuous, not corresponding with the pulse at the wrist; but this want of correspondence was not always constant. To violent and irregular palpitations, would succeed a strong, frequent, but regular action of the heart. The pulse ordinarily soft and small, became, during an exacerbation, hard, tense, and vibrating; the difficulty of respiration was extreme, and the slightest exercise produced an insupportable oppression. She could not lie for a moment in the horizontal position. Frequent fits of syncope.

The limbs became œdematous; and her expectoration was tinged with blood. She died on the 26th.

Dissection.—Body extremely œdematous, muscles pale; chest contained a large quantity of yellow serum; lungs and pleura presented no alteration; pericardium contained two pints of a fluid exactly resembling that in the chest; heart not much larger than in the healthy state. The superior and external surface of the right ventricle was loaded with fat of a soft consistence; the right auricle presented a cavity of twice the natural size, and the thickness of its parietes was

nearly tripled. The parietes of the right ventricle were more than double the usual thickness, and by this augmentation of substance the cavity was contracted. The sides of the left ventricle were also much thicker than natural, and its cavity presented a much more considerable narrowing than that of the right. The lining membrane was hard, shining, and fibro-cartilaginous. The mitral valve partook of this affection, and presented even some points of ossification. The left auricle offered nothing remarkable.

SOFTENING OF THE HEART.

The sound produced by the contractions of the heart, we have seen to be clearer in dilatation, and duller in hypertrophia. There is a disease of the heart, termed by the French authors '*Ramollissement*,' which consists in a softening of its muscular substance; and in which the sound is duller than natural, and in some cases disappears altogether.

When, with little impulse, both the contractions of the heart give an equally moderate, dull, and obtuse sound, we may suspect that the heart is softened, but still in good proportion. When this affection is combined with dilatation, the sound, though still clear to a certain degree, is, however, duller than when the latter disease occurs by itself. When it co-exists with hypertrophia, the sound of the ventricular contraction can hardly be heard, and in extreme cases disappears completely.

PATHOLOGY.

In this disease, the muscular substance of the heart is shrivelled, and so soft, that it can be easily torn; it is sometimes almost friable, so that the parietes of the ventricles break when pressed by the finger. When this takes place, the heart is generally found not more than half full of blood; when cut, the parietes of both ventricles collapse equally, whatever may have been their previous thickness. The colour of the heart is sometimes completely violet, but commonly it is of a pale yellow, which is frequently most evident in the central parts of the substance of the parietes, di-

minishing towards the outer and inner surfaces. It sometimes happens, that when the heart is altogether softened, and of a yellow colour, there are found here and there points of a red colour and natural consistence. This softening of the substance of the heart, accompanied by yellow colour, is most frequently met in cases where dilatation is combined with a slight degree of hypertrophia.

This disease takes another form, in which the colour of the heart is of a whitish hue; the substance is not so much altered as to become friable, but it is flabby, so that its parietes collapse upon being cut into. This affection is observed in cases of pericarditis.

OF PERICARDITIS.

The symptoms of this affection are very obscure. Lænnec himself has confessed, that even with the aid of the stethoscope, it is difficult of detection. M. Collin states, that in some cases of the acute species, he thinks there is heard a

sound similar to that of the crackling of new leather, which he attributes to the dryness of the serous membrane, the first consequence of its inflammation. A similar dryness takes place in inflammation of the conjunctiva, and the synovial membranes.

In chronic pericarditis, accompanied by effusion, the pulsations of the heart are obscure, tumultuous, and felt over a great extent of surface.

PATHOLOGY.

Pericarditis may be either acute or chronic. When the pericardium has been inflamed, it presents much the same characters as other serous membranes similarly affected. But the redness, so constantly met with in the acute inflammation of these tissues, is not so distinct in pericarditis. When it does appear, it is in patches, and the membrane has a punctuated appearance, as if covered by little points of blood. Lænnec states, that he has seldom observed thickening of the membrane to accompany the punctuated redness; and Bertin, that this alteration is but rarely observed in pericarditis. The organized, and firmly adherent false membrane, may have often

led to the idea that the pericardium was thickened. The albuminous concretion, which is afterwards to become an organized membrane, covers the pericardium either wholly or in part; sometimes it is equal and smooth, in other instances rough and unequal; and has been seen forming a beautiful network over the heart. Corvisart compares the appearance of the exudation in some instances to the internal surface of the second stomach of a calf. Its consistence is generally firmer than that which occurs on the inflamed pleura, and in course of time it is converted into an organized false membrane, forming adhesions similar to those observed as the consequence of pleuritis.

In a few cases, the inflammation is partial, and even a very small part of the membranes may be inflamed. Lænnec states the proportion between the partial and general affections to be as one to ten. But this proportion will be diminished, if we reckon as the effect of partial pericarditis, the occurrence of white, opaque, and large patches, of a horny consistence, which are frequently observed on the heart. On account of their thickness and strong adhesion, it is difficult to say whether they are situated on, or behind the peri-

cardium. The latter opinion was adopted by Corvisart, and he also thought that they were not the product of inflammation,* but both these positions are ably contested by Lænnec, in his work on Mediate Auscultation.

In chronic pericarditis the inflammation is more general, and the membrane is redder than in the acute species. The albuminous exudation is not nearly so frequent, and is softer. The serous effusion is more purulent and in greater quantity. In most cases of pericarditis, but especially the chronic, the substance of the heart is found pale, and sometimes softened; but instances are observed, where the muscular substance of the heart was firmer than natural.

DISEASE OF THE VALVES.

I HAVE now treated of the alteration in the intensity and extent of the sound produced by the contractions of the heart, as indicative of aug-

* Corvisart, page 45.

mentation in its size, thickness, and consistence. But there are certain sounds not heard in the natural state, which M. Lænnec first described as accompanying disease of the valves, or narrowing of the orifices of the heart; these are two in number, namely, what the above author terms "*bruit de rape*," and "*bruit de soufflet*;" the first analogous to that produced by a saw, and the second to that of a bellows.

The first of these sounds is considered by M. Lænnec to be indicative of ossification of the valves, their cartilaginous induration, or the growth of warty excrescences on them.

When the mitral valve is affected, the sound of the auricular contraction is more prolonged, duller, and accompanied by a grating noise, which resembles that produced by a saw when drawn over a piece of wood. When the hand is placed over the heart a vibratory sensation is perceived.

When the tricuspid valves are affected, the sound is heard on the right side, while it is distinguished from that produced when the sigmoid valves are thus diseased, by the sound in the latter case being isochronous with the contraction of the ventricles, which is more or less prolonged.

The cause of the second species of sound is still involved in great obscurity. This phenomenon appears to accompany contractions of different parts of the heart or arteries, but may, however, be produced in some individuals, especially those of a nervous temperament, without any alteration in the functions or structure of the heart. It is heard whenever we compress an artery, and listen to its pulsations by means of the stethoscope; also before hæmorrhages, in the vessels that carry blood to the part where the bleeding takes place, and generally in palpitations arising from any cause whatsoever. It is of a peculiarly inconstant character, appearing and disappearing in a short space of time; and may thus frequently mislead an inexperienced observer.

PATHOLOGY.

The state of ossification, or cartilaginous induration, generally occurs in the mitral valve and sigmoid valves of the aorta. The tricuspid valve and sigmoid valves of the pulmonary artery are sometimes, though much more rarely affected.*

* See *Journal de Médecine*, vol. XIX. page 468, for a good case of ossification of the tricuspid valves.

The cartilaginous induration of the mitral valve may occur either wholly or in part; it is, however, generally thicker at the points and base than elsewhere. The ossification of the valve occurs under the same circumstances, with respect to situation and inequality of thickness. Like the former affection it is first developed in the duplicature of the membrane forming the valve, which it penetrates. The valve is seldom perfectly ossified, and gives a sensation, as if a number of minute stony fragments were pressed between the fingers.

When the edge of the valve is thus affected, the tongue-like processes of which it is composed are united, or, as it were, soldered together, thus forming an aperture sometimes so narrow as scarcely to allow a quill to pass through.

Ossification of the sigmoid valves of the aorta generally commences in the corpora aurantia.

When the ossification is very extensive, the valves are united; they curve either inwards or outwards, and resemble to a certain degree some species of shells. In this state they are immoveable, and diminish considerably the aortic orifice.

The growth of warty excrescences, or *vegeta-*

tions as they have been termed, may take place either on the valves, or the internal parietes of the heart. In the first case, the excrescences resemble the syphilitic warts which occur on the glans penis, or orifice of the vagina; sometimes they are very adherent, in other instances they can be easily detached. Those which are found on the internal surface of the heart are globular, and generally filled with a grumous or purulent matter. M. Lænnec conceives that these are fibrous concretions, organized in the same manner as the false membranes described when treating of pleurisy.

CASE XV.*

A woman aged 68, of large size, and rather strong constitution, but with the chest long and narrow, the sternum projecting above and depressed below, was admitted into the hospital Cochin, on the 4th of November 1822, on account of a disease which she attributed to the fatigues of her business. She was in the habit of vomiting blood

* Bertin.

for more than five years. For three months she was tormented by symptoms indicating aneurism of the heart. Upon her entry she had cough, feeling of constriction in the middle of the chest; orthopnæa threatening suffocation; countenance purple, lips swollen; pulsations of the jugular veins isochronous with those of the carotids; palpitations; pulse irregular, unequal, intermittent, frequent and very small, although the pulsations of the heart were very strong. The pulsations of the ventricles were irregular and intermitting; these intermissions in general were preceded by two sharp rapid contractions immediately succeeding each other. The contractions of the left ventricle gave an impulse rather strong, and produced a sound somewhat clear. Those of the auricles were accompanied by a sound like that of a bellows; the hand applied to the region of the heart felt a deep, vibrating, but distinct motion, and was suddenly raised by the ventricular contraction. The lower extremities were œdematous.

Diagnosis.—*Contraction of the left auriculo-ventricular aperture; hypertrophia and dilatation of the left ventricle.*

On the following days the beatings of the heart

became sensibly slower, but œdema attacked the upper extremities; the lips presented a violet colour; she could not enjoy a moment's sleep.

On the 15th of November, eleven days from her admission, she died suddenly, although she appeared not worse than usual. A sound like that produced by a file continued to the very last to accompany the pulsations of the heart.

Dissection, 24 hours after death. Lips and face of a dark violet colour; considerable œdema of the limbs. The heart, enormously distended by clots of blood, was three times the size of the closed hand of the patient. The clots being removed, it became flabby, and was still by a third larger than usual; the left ventricle was dilated, and its sides, affected with hypertrophia, were seven or eight lines thick towards its base. The columns which are attached to the mitral valve were very strong. The right ventricle, thicker than in the natural state, was not visibly dilated. The auricles were both dilated and thickened, but the left was by a third larger than the right; the substance of the heart was sufficiently firm, and of a red colour. The mitral valve, quite deformed, was thick, hard, and fibro-cartilaginous; the left au-

riculo-ventricular orifice was so much narrowed, that it scarcely admitted the end of the little finger; it formed a circular opening, the rounded edges of which, possessed of much resistance, presented a polished surface. The tricuspid valve was changed into a kind of band, from two to four lines broad; only one point of the valve was distinct, and was converted into a fibro-cartilaginous tubercle.

The right auriculo-ventricular orifice, greatly enlarged, could not be closed by its valve. The valves of the aorta were thickened without narrowing of the aperture to which they were adapted. The pericardium covering the heart presented a whitish pseudo-membranous patch, and was studded with miliary granulations, which resembled venereal warts. The pleura, red and injected, was thickly beset with granulations similar to the preceding. These albuminous granulations, more numerous on the pleura lining the diaphragm, were there united into bunches like grapes. The left lung crepitated well; the right was loaded with a sero-sanguineous fluid; and the bronchial membrane was red.

OF ANEURISM OF THE AORTA.

If, on applying the stethoscope upon the right superior part of the sternum, or under the right clavicle, we hear pulsations, and perceive an impulse isochronous with the pulse, much stronger than that of the ventricles in the præcordial region, we may suspect that the ascending aorta or its arch is dilated, as it is extremely rare to find, even in hypertrophia, that the impulse is perceived beyond the præcordial region. If this phenomenon is found constant after many examinations, it may be looked upon as affording a sure diagnosis of aneurism. In these severe cases, the pulsations are heard in the superior dorsal region.

Aneurism of the abdominal aorta may be easily recognised by means of the stethoscope. In this case we hear the pulsations with a degree of intensity which could not be expected from the application of the hand over the affected part. The pulsations are *simple*, for the contraction of the auricles is not heard, even when the aneurism is above the trunk of the cœliac artery. The

sound is clear and distinct, like that of the auricles, but is much stronger.*

As the pathology of aneurism has been so well described by British authors, and especially by Mr. Hodgson, in his admirable work on the diseases of the arteries and veins, I think it superfluous to enter into any description of it here.

In the case immediately following, the utility of the stethoscope, in detecting aneurism of the aorta, is fully established. The patient, indeed, had palpitations, dyspnœa during exercise, tendency to syncope, and an irregular pulse; but all these symptoms may occur in other diseases, and, at least, only indicated disease of the heart. A physician without the aid of the stethoscope would have explained all the symptoms by the diseased heart, most probably the consecutive affection; and would thus, as M. Bertin justly

* The occurrence of pulsating tumours in the abdomen frequently leads to the conclusion that there exists an aneurism of the aorta. But in many cases these tumours are not connected with the aorta, but occur in the adjacent parts; as may be proved by applying the stethoscope on either side of the tumour, when the arterial pulsation will be found natural.

observes, have mistaken the effect for the cause. This author relates another case of diseased heart, with aneurism of the aorta, where many of the symptoms must have arisen from the compression of the lungs, caused by the aneurismal tumour.

CASE XVI.*

A man aged fifty-five, of a rather weak constitution, entered the hospital on the 20th of November, 1822, mentioning that for the last three years he had been subject to palpitations and a sense of suffocation, which he attributed to numerous attacks of catarrh. He now presented the following symptoms. Skin of a pale yellow colour. Sense of weight in the head, with vertigo; numbness of the lower extremities; sputa thick and mucous; sensation of weakness in the epigastric region, with tendency to nausea; feeling of suffocation on the slightest exercise; pulse irregular, intermittent, unequal; and not synchronous with the pulsation of the heart.

Auscultation.—The respiratory murmur was heard sufficiently distinct over the whole chest;

* Bertin.

the pulsations of the heart were heard over the entire extent of the thorax. Those of the ventricles, when explored in the præcordial region, were very unequal and intermittent; their sound was clear and sonorous, but the impulse was not strong; after some weak contractions, strong and abrupt pulsations would suddenly follow. Under the sternum, and cartilages of the first ribs on the right side, were heard simple pulsations, accompanied by a very distinct sound, and a peculiar hissing. Towards the clavicles the auricular contraction was distinctly heard, although obscure in the præcordial region.

Diagnosis.—Aneurism of the ascending aorta. Hypertrophia, with dilatation of the ventricles.

He died on the 14th of January, 1823, and the body was examined forty-eight hours after death.

No œdema. The left side of the chest contained less than a pint of reddish serum. Both lungs in general healthy, but the left was much smaller than the right, being compressed by the effusion. Redness of the bronchial membrane and pericardium. The heart was a third larger than natural; the left ventricle, three times greater than the right, could contain a goose egg; its parietes were six lines in thickness at the base.

The corresponding auricle, equally dilated, was evidently in a state of hypertrophia. No disease of the valves.

The whole of the ascending aorta was dilated; forming an oval tumour, equal in size to the closed hand of the subject. The sac presenting the three arterial membranes, contained a white fibrinous mass, not divided into distinct layers, and the arterial parietes were much thickened. That portion of the pericardium which is reflected on the origin of the aorta, and also the cellular membrane of this artery, were both of a red colour. The internal membrane of the latter was perforated by ulcerations, and beneath it was observed a pultaceo-atheromatous matter, of a yellowish colour. In the whole of its extent this membrane could be easily separated. In the rest of its course, the aorta preserved its natural calibre; but its parietes were thick and hard, so as to grate under the knife by which they were divided. Its internal surface was covered with cartilaginous or osseous plates, some of which had penetrated the internal membrane. We also observed a great number of ulcerations here, many of them deep, and of a blackish colour; others more superficial, and only affecting the

internal membrane, which, in the intervals, was rough and unequal. This alteration was continued into the arteries immediately arising from the aorta, and narrowed in an unequal manner the mouths of those given off from the arch.

The mucous membrane of the stomach presented a vivid punctuated redness, while that of the duodenum was very pale; it was red, and beautifully injected in the small intestine, and in the large was of a pinkish hue. Peritonitis.

APPENDIX.

APPENDIX

APPENDIX.

No. I.

OF GANGRENE OF THE LUNG.

This has been considered by Lænnec and Andral, as an idiopathic disease of the lung, similar to anthrax, and other gangrenous affections. M. Bayle ranked it among his species of phthisis, under the name of "*phthisie ulcereuse.*" But later observations have proved, that in several instances, gangrene of the lung has been the consequence of inflammation of this organ, whether acute or chronic; and that this is the case in almost every instance seems now highly probable. The disease is rare, and some time must elapse before the question can be set at rest. I will not at present, therefore, discuss the matter, but pro-

ceed to the pathology of this affection, which has been well described by Bayle and Lænnec.

Gangrene of the lung may occur under two forms; in the first, it is circumscribed, and in the second, affects a more or less considerable portion of the lung. The latter form is considered by Lænnec as the rarest of the pulmonary affections; he mentions to have seen it but twice in eighteen years, and during that period, only six cases of it occurred in the different Parisian hospitals.

The circumscribed gangrene is described by M. Bayle under the name of the ulcerous phthisis; according to him, the excavation occurs in the pulmonary tissue, and is not lined with a distinct membrane like the tubercular cavity. It may occupy the surface of the lung, but is most commonly found in the interior of this organ. When not complicated with other affections, the ulceration may occur in the centre of a lobe, while around it the pulmonary tissue is healthy and crepitating. It almost always exhales a very fetid and gangrenous odour; and its surface, which is very irregular, is generally covered with a greyish brown, or even black purulent matter. Its extent is variable, sometimes it may contain a

nut, in other instances it is capable of holding three hen's eggs.

Lænnec describes three stages of this disease: first, that of recent mortification or gangrenous eschar; secondly, that of deliquescent sphacelus; and thirdly, that of excavation, formed by the evacuation of the gangrened part. He also states, that in some cases, the parietes of the excavation may become lined with a soft and opaque false membrane of a greyish hue, secreting pus of the same colour, and exhaling the gangrenous odour. But this membrane frequently does not occur, and the parietes of the ulcer are then dense, of a greyish brown colour, and when cut, present a granulated aspect. This state of induration, evidently produced by the third degree of inflammation of the lung, generally extends to about an inch from the excavation, but has been seen to occupy the whole of a lobe. In other instances, the parietes of the cavity are soft and as if putrid; isolated and denuded blood vessels are sometimes seen to traverse the excavations; but they have been found destroyed, while their mouths, opening into the excavation, have filled it with a clot of blood.

The *uncircumscribed* gangrene of the lung, ac-

cording to Lænnec, presents the following characters. The pulmonary tissue is moister and more friable than in the natural state; its density is the same as in the first degree of pneumonia, œdema of the lung, or in the sanguineous infiltration which occurs in dead bodies. Its colour varies from a greenish white to a dark green, sometimes with a mixture of brown, or brownish yellow. These shades occur in different parts of the lung; and we may also distinguish more humid portions of a livid red, which appear infiltrated with very fluid blood, exactly similar to the lung in the first stage of inflammation. Here and there we observe points in a state of putrid softening, while a sanious liquid of a greenish colour, and insupportable fœtor, flows from the surface of the incisions.

This lesion may occupy nearly the whole of the lung. In some points the healthy pulmonary tissue passes insensibly into the gangrened portions; but it may occur separated from it by a portion of lung inflamed to the first degree. This separating portion may be partially hepatized, but it rarely happens that we find it in this state.

In the following cases, gangrene of the lung succeeded to an inflammatory affection of this

organ, in the first instance acute, and in the second manifestly chronic. The latter position is proved by the duration of the disease, and the hardened state of the lung, described in the account of chronic pneumonia, as the consequence of this affection.*

A man, aged twenty-eight, on the 25th of August, 1822, drank a large quantity of cold water, while he was in a state of copious diaphoresis. The sweating was suppressed, in a few hours he was seized with rigors, and in the evening felt an acute pain below the right breast, with oppression and dry cough. These symptoms continued until the 27th, when he was bled. On this day the sputa became sanguinolent. Thus he continued until the 9th of September, sixteen days after the invasion of the pneumonia. On the next morning he presented the following symptoms: his face was pale and of a leaden hue; debility and emaciation excessive. There was no longer any pain of side. He complained of difficult respiration, and lay on his back, inclining a little to the right side; he coughed frequently, and expectorated a liquid of a brownish red

* See page 41.

colour, resembling the prune juice sputa in the third degree of pneumonia.* Percussion on the right side of the chest gave no resonance behind or laterally; neither respiration nor rale was heard in this direction. His pulse was frequent without increased heat of skin; digestive functions natural.

M. Lerminier announced the existence of pneumonia in the third degree.

Blister to the right side. Diaphoretics.

He continued in this state until the 21st day, when the matter expectorated at night seemed to exhale a fetid odour. On the day after, its character was changed in a most striking manner; it consisted of a liquid of a dirty green colour, and possessing a most disgusting fœtor. On the following morning the dullness of sound on the right side had diminished, and where, on the preceding evening, respiration was inaudible, a distinct gurgling sound was now heard. From this, one should conclude either that a collection of pus, formed in the pleura, had escaped by a passage through the bronchial tubes, or, what is more probable, that a communication was established

* See translation of Andral's Thesis.

between one of these canals, and an ulcerous cavity, the consequence of gangrene of the lung.

On the following days, the fœtor of the sputa was increased; their colour becoming more and more characteristic, seemed to announce gangrene of the lung almost to a certainty. From this time the patient sunk with amazing rapidity; his face had a cadaverous aspect. He still persevered in lying on his back, with a slight inclination to the right side. If he raised himself a little, the sputa flowed into the trachea in such quantity as to threaten instant suffocation. Constant sweats, which were fruitlessly opposed by preparations of cinchona, and by the acetate of lead, proved a new source of exhaustion. On the 26th of September, a copious diarrhœa set in, which continued to the 5th of October, when he died. His sputa latterly were tinged with blood.

Dissection.—In the lower lobe of the right lung was a vast cavity, with ragged brown parietes, which exhaled a gangrenous smell, and contained a pultaceous semi-fluid mass of a greenish grey colour; large bronchial tubes opened into it, and it was only separated from the ribs by a very thin portion of pulmonary tissue. Around this cavity, which could contain an orange, the parenchyma

of the lower and middle lobes presented a mixture of red and grey hepatization. The back part of the superior lobe of the left lung was of a red colour, when compared with the remaining portion, whose tissue, pale, easily torn, and scarcely permeable to air, presented the transition from the first to the second degree of inflammation.

The gastro-intestinal membrane through its entire extent was found of a very pale colour.*

CASE II.

A labourer was afflicted for eighteen months, with a pain under the left breast, and hæmoptysis. Three weeks before his entrance into the hospital the latter symptom increased, so as to oblige him to leave his occupations.

On the 3d of July, 1824, he presented the following symptoms.

Sound on percussion dull over the whole left side of the thorax, as well anteriorly as posteriorly. A mucous rale, approaching to the gurgling sound of half filled excavations, was heard a

* See Clinique Medicale. Tome I. p. 425.

little below the inferior angle of the scapula, and at the same point we heard the bronchial respiration, with a very strong resonance of the voice. In the other parts of the same side, nothing was heard but varieties of the bronchial rale, such as we have already so often remarked. On the right side resonance was perfect; the respiratory murmur was strong and distinct, with the exception of some points where a little of the bronchial rale was heard. He spoke with ease; his respiration did not seem to be in any degree impeded; breath fetid; the sputa very abundant, consisting of a greenish white purulent liquid, which exhaled a nauseous disagreeable smell. Pulse rather quick, without much heat of skin. Towards evening he felt uneasy, and had then a general sensation of heat, not preceded by a cold fit; sweats at night. The digestive functions are not deranged. Strength pretty good.

On the 5th of July, in the morning, his pulse was quicker, and heat of skin increased. No remarkable change took place until July 22, when the characters of the sputa were altered. A matter formed by a number of small grey particles, of a very fetid smell, began to mix itself with the purulent liquid already mentioned. During the

following days these greyish sputa, at first scanty, became more and more copious and fetid; on approaching the patient's bed there was perceived a heavy gangrenous smell, arising both from the expectoration and breath. Since the sputa afforded these new characters, the pulse was constantly small and rapid, and the face remarkably pale; each morning the patient was found reclining on his left side. Three or four times he vomited his food. His strength, however, did not diminish, his respiration did not become more impeded, nor did his emaciation increase. Although the prognosis was unfavourable, yet the fatal termination seemed distant.

August 9. The patient arose as usual, went into the garden of the hospital, and remained there for two hours. For the rest of the day, he seemed in the same state as on the preceding week. In the evening, while walking in the ward, he felt ill, and was supported to his bed. At ten o'clock he was heard speaking freely, in a loud tone. His countenance was observed to be somewhat changed. In a few minutes after he expired.

Dissection.—Close adhesions between the pleura costalis and pulmonalis of the left side. All the

lung of this side was hard and impermeable to air; when squeezed between the finger, its tissue did not break. When cut or pressed, no liquid flowed from it. Its colour, differing very little from that of the healthy lung, was of a greyish red. When cut in different directions, it appeared strewed with innumerable yellow granulations of extreme minuteness. On its surface, and internally, it presented a great number of white lines, which intersected each other in such a manner as to circumscribe exactly the lobules of the lung, whose boundaries were thus perfectly defined. These lines seemed to be formed by condensed and fibrous cellular tissue, which in its natural state separates the lobules.

Towards the middle of this lung, near its external surface, there existed a cavity capable of receiving a large walnut. A gangrenous smell arose from it. Its parietes were lined by a thin layer of greenish matter, through which was seen the red and hardened tissue of the lung. Many large bronchial tubes opened into this cavity, which was empty. The internal surface of these tubes was red, and the parietes of many present were evidently thickened. In some parts they were dilated in such a manner as to resemble

small cavities. It was particularly towards the centre of the lower lobe that these partial dilatations were found. They contained a greyish fetid matter, resembling the sputa. The right lung was free from adhesions, and healthy in its entire extent, except near its base, where it presented a portion hepatized and red, about the size of an orange. This was of recent formation, as we concluded from its great friability.

No. II.

ABRIDGED TRANSLATION OF M. ANDRAL'S THESIS ON EXPECTORATION. PARIS, 1821.

The matter of expectoration is furnished by many sources. It most commonly arises from the mucous membrane of the bronchial tubes; but this membrane, subjected as all exhalant surfaces are, to a thousand different causes of irritation, can secrete fluids which vary infinitely with regard to their physical character and chemical composition. Thus, according to the particular stimulus applied, it secretes a viscid mucus, transparent and bloody in pneumonia; limpid and colourless in acute catarrh; opaque and puriform in the chronic species; concreting into false membrane in croup, &c. &c.

With these different productions of the bronchial membrane, are also combined, in varying quantities, saliva, the liquid furnished by the tonsils and other glands of the inside of

the mouth, and the mucus secreted in the pharynx.

Sometimes the expectoration is of pure blood, which may have various origins.

In other instances, it is composed totally or in part of different accidental productions, such as tubercles, calculi, melanotic matter, hydatids, &c. developed in the pulmonary parenchyma, which they have more or less altered.

Finally, in some cases, purulent matter formed originally in the cavity of the pleura, in the mediastinum, and more rarely in the liver, has been discovered in the expectoration.

Is it possible, in the present state of science, to pronounce what is the state of the lungs, from an examination of the characters afforded by the expectoration? In many cases, most undoubtedly it is. In the case of pneumonia, for instance, after inspecting the sputa, we can not only announce the nature of the disease, but even trace its different stages, in a manner sufficiently precise. In other cases, as for instance in that of phthisis pulmonalis, the problem becomes much more complicated, and sometimes even cannot be resolved.

The consideration of the nature of the sputa

is of importance, not only in aiding our diagnosis of pulmonary diseases, but their inspection even affords to the physician many useful hints, which are more or less certain, with regard to the progress of the disease, its duration, and termination, whether near or distant, fortunate or the contrary.

In some cases the sputa are looked on as critical, and many affections resolve themselves by a salutary expectoration. In other cases they are secreted so suddenly, and in such abundance, that in a few hours the patient expires from suffocation.

Such are the principal points in which we have viewed our subject. We propose to treat successively of the expectoration of catarrh, of pneumonia, of pleurisy, and of phthisis. We shall then examine the rare diseases in which an unusual expectoration has been observed.

OF THE EXPECTORATION IN PULMONARY CATARRH.

In the commencement of this affection, the cough is dry, and its continuance in this state marks

the first period of the disease. In the course of time, according to circumstances, it is followed by the expectoration of a transparent glairy mucus, similar to the white of an egg, and of great tenacity. It is sometimes thready. Its tenacity is greater, in proportion to the violence of the inflammation; thus in severe cases it acquires such a remarkable viscidity, that upon inverting the containing vessel, it is seen to adhere to its edges by long striæ, and is then somewhat similar to the sputa in acute pneumonia. This viscidity continues during the febrile paroxysm, and might lead an inexperienced practitioner to suppose that there was commencing inflammation of the pulmonary tissue; but by observing the sputa after the cessation of the paroxysm, he will find that they have lost their viscidity, and is thus undeceived.

In some cases, during the paroxysm, the expectoration is altogether suppressed, indicating great irritation of the mucous membrane.

We sometimes observe, at the close of the diaphoresis which terminates the paroxysm, a copious, thick, and opaque expectoration, similar to that which is seen in the last stage of acute bronchitis; but this is only for a time, and the

patient soon expectorates a clear mucus, as before the access of fever.

A greater or less quantity of froth generally occurs on the surface of the sputa; its quantity depending on the facility with which they are rejected. If the patient only expectorates after a long fit of coughing, during which the air, often inspired and expired, is intimately mixed with the mucus filling the air passages, the sputa are combined with a great quantity of this fluid, forming a froth on their surface, which is very difficult of separation.

In the first stage, the sputa are often streaked with blood, which has proceeded from the rupture of small vessels, caused by the efforts of coughing. The blood is only *mixed* with the mucus, not *combined* with it, as in the sanguinolent expectoration of pneumonia.

There sometimes occur, mixed with the expectoration, small grains of a whitish colour, which do not come from the lung, but are secreted by the numerous glands in the pharynx, &c. This remark is of importance, as these grains have been mistaken for the debris of pulmonary tubercles.

So long as the sputa present the above aspect, we may conclude that the inflammation is not proceeding to resolution; but as soon as this change is about to take place, their character is changed, they lose their transparency, and become mixed with yellowish white, or greenish opaque masses, which, gradually increasing, form at length the entire of the sputa, and announce that the inflammation has resolved itself. Nothing can be more variable than the characters of the sputa towards the conclusion of acute catarrh.

When the disease, instead of terminating by resolution, passes into the chronic state, the sputa continue of the same appearance as in the last stage of the acute inflammation. They are opaque, of a whitish yellow or greenish colour; sometimes adhering to the bottom of the vessel, sometimes suspended in a transparent mucus. They are most frequently inodorous, and appear insipid to the patient; their expulsion is easy, and it is in the morning that they appear in greatest quantity.

It is often very difficult to distinguish between the sputa in chronic catarrh, and those in phthisis; but I shall reserve what is relative to this sub-

ject, until I treat of the expectoration of the latter disease. In some cases a pulmonary catarrh may remain for a great length of time with an expectoration similar to that in the acute stage. This is then an indefinitely prolonged *acute* inflammation, the existence of which is proved not only by the character of the expectoration, but also by all the other symptoms; as the sensation of heat and oppression in the interior of the chest, violent and painful fits of coughing, heat of the skin, &c. Hence the necessity of a mild antiphlogistic regimen during the long period of the disease.

When chronic catarrh lasts for a long time, and is accompanied by a copious expectoration, hectic fever and death may be the result. In a case where the pulmonary tissue was not affected, this fatal termination arose, in my opinion, from the excessive secretion of the bronchial membrane. The quantity of matter expectorated each day, and this often for a length of time, is truly astonishing. Some sink rapidly, presenting a series of symptoms analagous to those of phthisical patients; others die of exhaustion before a well characterized hectic is established; while some, on the contrary, support this enor-

mous flux, without any evident constitutional affection.

The abundant secretion of the bronchial membrane, appears to be one among the many causes of asthma. Individuals subject to this excessive exhalation, have usually a slightly laborious respiration. If, from any cause, they cease to expectorate as freely as usual, or if the secretion should be suddenly increased, they are immediately threatened with suffocation; but upon the removal of the obstructing cause, the dyspnœa rapidly diminishes, and the patient soon recovers.

We have seen some very rare cases, in which a very large quantity of puriform mucus was suddenly secreted from the bronchial membrane, and causing death by asphyxia in a few moments.* The following is a case of this affection.

A man, complaining of difficulty of respiration, and who had been attacked with pleuro-pneumony during the last year, remained in the hospital for fifteen days, with the chest dull on percussion over the whole right side. On the 16th of September, he awoke in a state of threatening

* See Van Swieten, Comment. vol. iv. page 60.

suffocation, and in a short time expectorated, or almost appeared to vomit, an enormous quantity of sputa, which formed a homogeneous mass of a yellowish green colour, with but little smell; and liquid enough to flow from the vessel containing it. We conceived that a pleuritic effusion had burst into the bronchial tubes; but the liquid continually passing into the larynx and trachea, soon filled them, so that expectoration could not take place; and the patient died of suffocation.

Upon dissection, we found the two inferior thirds of the right lung, in a state of grey hepatization. On cutting the lung, we observed a liquid similar to that expectorated, to flow from a multitude of points, which were the orifices of small bronchial tubes, so that this liquid filled and obstructed all the air passages. The larger divisions of the bronchial tubes, the trachea, and larynx, were equally full. The left lung was healthy, but the larger bronchial tubes were filled with the same fluid, which doubtless must have flowed back into them. The smaller ramifications were empty.

It sometimes happens that the expectoration in chronic catarrh occurs periodically. There

is a case of a woman related in "*les Ephemerides des Curieux de la Nature,*" who had monthly an expectoration of pus, of a fœtid odour, often amounting to three pounds. She was otherwise in good health, and had no cough except at the period of expectoration. The menstrual flux was very scanty. Baumes, in his treatise on phthisis, mentions similar cases.

At other times, an abundant muco-puriform expectoration occurs at the close of a disease, and appears to be the crisis of it. Of this, we have a remarkable instance in the third book of Hippocrates, *De morbis vulgaribus.*

Experience teaches that many of these abundant expectorations are to be looked upon as natural discharges, not to be interrupted with impunity; and analogous to those of certain ulcers, whose cure is often followed by the worst consequences.

Every acute or chronic disease of the lungs or pleura; most of the organic affections of the heart; many of the diseases of the stomach and liver; and some diseases of the skin, affect the bronchial membrane more or less; hence the complications of pulmonary catarrh. But, as we have said before, the secretion varies according to each differ-

ent irritation. Let us examine some of these varieties.

The frequent and distressing cough observed in patients attacked with gastritis is generally dry, but it may be accompanied by an expectoration differing in character according to the degree and duration of the bronchial irritation. M. Broussais conceives, that in reducing the symptoms of gastritis by a proper treatment, we can check the expectoration without detriment to the patient; while in cases of true bronchial inflammation, it must not be put a stop to, until it has acquired the yellowish white colour, and consistance, denominated by the ancients, *coction.*

The yellow colour of the sputa has been regarded by many authors as one of the characteristic signs of hepatic inflammation; but when cough accompanies this disease, it is generally dry, as in gastritis.

In many bilious fevers the sputa have a distinctly yellowish colour. In jaundice their colour is very variable; sometimes white, while all the other liquids of the body have a strong yellow colour; in this case the tongue remains white. At other times the sputa have a distinctly yellow colour, and the tongue is then of the same hue. We

have seen one case of icterus, where the sputa were so green that they seemed to be impregnated with the resinous matter of the bile; and it was remarkable, that the thick crust covering the tongue was of a similar colour.

In the catarrh which accompanies rubeola, the expectoration towards the close of the disease has a great analogy to that in phthisis; of this I have seen an instance.

The expectoration of pulmonary catarrh presents yet another variety. It sometimes happens that persons labouring under adynamic fever, at an advanced stage of the disease, expectorate a small quantity of thick, viscid, ash-grey sputa, similar to those in some chronic cases of pneumonia, or rather resembling the purulent matter expectorated by phthisical patients a short time before death. Nevertheless, in the above cases, we find no lesion of the pulmonary tissue.*

In cases of dilatation of the bronchial tubes, the patients are frequently affected with cough and muco-puriform expectoration.

* Many cases of typhoid fever have been observed in the Parisian hospitals, where the sonorous rale became suddenly evident towards the close of the disease. T.

OF THE EXPECTORATION IN PNEUMONIA.

Among the symptoms which most certainly point out the existence of acute inflammation of the lung, must be reckoned the state of the expectoration. The following are the general characters of pneumonic expectoration; they are so striking that we cannot confound them with any other.

The sputa are transparent, tinged with blood, uniting into a gelatinous mass, and so viscid, that we may invert the vessel in which they are contained, without their being detached from its sides. But this short description is far from being sufficient, for the sputa do not present the same appearance in the different stages of the inflammation. In some cases their character is totally different, while in others the pneumonia goes through its different stages, without its existence being announced by the expectoration, which may be altogether wanting, or ambiguous in its character.

We shall first describe the expectoration as it is usually observed in the course of a pneumonia.

At the commencement of the disease, when there is already cough, dyspnœa, fever, and a deep seated pain in the thorax, the patient only expectorates a little bronchial mucus, mixed with saliva. The chest still gives a clear sound on percussion, but the crepitating rale begins to be heard on one side of the thorax, while on the other, the respiratory murmur is stronger than in the natural state. According as the rale becomes more evident, the expectoration is more characteristic; and this generally happens on the second or third day. The sputa are tinged with blood; in proportion to the quantity of this liquid, they are either yellow, of a ferruginous colour, or of a bright red. At the same time they become viscid, and form a transparent and homogeneous mass: but on inclining the vessel in which they are contained, they still flow out easily. Thus, at this period, the sputa adhere strongly together, *but have not enough of viscidity to adhere to the sides of the containing vessel.*

Frequently, during the entire course of the pneumonia, the sputa present the above characters; and in this case, the inflammation does not pass from the first degree. But when the pneumonia has made progress, and passes from the

first to the second degree, namely, to that of red hepatization, the sputa acquire a much greater viscidity, *and no longer detach themselves from the vessel.* The chest is dull on percussion, and the respiratory murmur can be no longer heard. The inflammation is now at its highest degree of intensity, and the sputa remain for some time stationary; but according to the termination of the disease, they present new characters.

If resolution is about to take place, their viscidity and sanguinolent appearance diminish. At first, in order to separate them from the vessel, we must agitate it a little; a little later a slight inclination will suffice; by degrees they return to their pristine state; and at length are similar to those in common acute catarrh. An exacerbation of the disease is certainly proved, by the sputa again becoming viscid and sanguinolent; when this takes place, all the other symptoms are observed to increase in severity.

Is the resolution of pneumonia promoted, as Cullen says, by the expectoration of a thick yellowish white matter, marked by some striæ of blood, and rejected in great quantity, without violent efforts of coughing? It appears demonstrated to us, from a great number of observa-

tions, that such an expectoration is not required for the complete resolution of this disease; and that it may terminate favourably, although the sputa, which have lost their viscidity, and are no longer tinged with blood, remain aqueous, transparent, and colourless; and at length cease to be expectorated, without having acquired a greater degree of *coction.*

We will, however, commit a great error, if, from the inspection of the sputa alone, though they may have become purely catarrhal, we conclude that perfect resolution of the pneumonia had taken place; for it not unfrequently happens, that the state of the expectoration, with all the other symptoms, shall indicate a complete resolution, while the dulness of sound, and crepitating rale still continue. We have seen these latter signs survive, as it were, all the other symptoms for ten, twelve, or even fifteen days.*

We less frequently observe that the pneumonic expectoration continues after the cessation, or, at least, the amelioration of the other symptoms. Of this, we have seen a remarkable example, where nine days after convalescence the sputa preserved their pneumonic appearance.

* See page 50.

Hippocrates regarded as a favourable symptom, and as one likely to hasten the resolution, that expectoration should be established before the fourth day. When it occurs later, it is not an advantageous symptom, for the strength of the patient gradually diminishing with the increasing viscidity of the sputa, causes the expectoration to be more difficult; hence the dyspnœa is increased, and the disease becomes more severe. For this reason, a great viscidity of the sputa at the commencement of the disease is always an unfavourable circumstance, and one that will retard or prevent resolution.

When, in place of resolution, the pneumonia tends towards suppuration, the sputa present new and important characters.

In a majority of patients, the excretion of the sputa becomes difficult and scanty, and at length ceases altogether; but it generally happens, that the secretion of the matter of expectoration continues, while its excretion is impossible, owing to the debility of the patient. Hence it accumulates in the bronchial tubes, trachea, and larynx, obstructs these passages, and death from asphyxia is frequently the result. The strong tracheal rale

which is then heard, proves that the suffocation is owing to the retention of the sputa.

In other patients, the secretion of the matter of expectoration ceases in a more or less sudden manner. The state of the bronchial membrane may be then compared to that of wounds, whose surfaces, after a long suppuration, have become suddenly dry.

Among the many causes which diminish or suspend the secretion of the bronchial membrane, may be reckoned the numerous diseases which are so often complicated with pneumonia. According to *Baglivi*, the exhibition of great quantities of purgative medicine at the commencement of the disease, suppresses the expectoration, and is consequently hurtful. *Morgagni* regards untimely bleedings, especially in cases of old persons, as calculated to produce the same effect. *Sydenham* says, that bleedings too often repeated will suppress expectoration; but when performed with judgment, they will often re-establish it.

The physician, faithful to these principles, will find that the detraction of a certain quantity of blood is often the best of expectorants.

When suppressed expectoration arises from retention of the sputa in the air passages, the case

is always severe. But when the patient no longer expectorates, on account of the secretion from the bronchial membrane being put a stop to, we must be careful not to form any prognosis, without considering all the other symptoms. We have sometimes seen patients labouring under the most intense pneumonia, suddenly cease to expectorate, without any injurious result being the immediate consequence; in these cases, however, the recovery of the patient generally took place in a very slow manner.

We have not observed what is stated by some authors, that another excretion was established at the time that the expectoration was suppressed. In some patients, threatened with immediate death, the sputa are not suppressed, but are changed in their aspect. During the last twenty-four hours of their existence, many of these patients expectorate a small quantity of opaque sputa, of a dirty reddish grey colour, and collected into masses; having a great analogy to those of phthisical patients immediately before death.

In some rare cases the expectoration continues until death, with the same characters, and in the same abundance as if the pneumonia was proceeding to resolution.

In fatal cases, when the lung was found infiltrated with pus, some of the patients ceased to expectorate; the sputa of others was of the opaque reddish appearance above described; but, in the majority, we have found the sputa to lose their gelatinous appearance, viscidity and reddish colour; and to be formed of a brownish, sometimes black liquid, bearing a strong resemblance to the juice of prunes.

We have, nevertheless, seen the above appearance of the sputa, in patients whose lungs were found in the state of red hepatization. Even in a slight case of pneumonia, where the inflammation did not pass the first degree, we have observed this character of the expectoration. These anomalies should convince us, that the inspection of the sputa can only furnish us with probable conjectures, but never with *absolutely* certain information as to the progress of the disease, or its probable termination.

It only remains for us now to consider the expectoration in cases of acute pneumonia, which have passed to the chronic state; or rather of primitive chronic pneumonia. Here the sputa present all the different shades of character which occur in pulmonary catarrh.

If there is an exacerbation of the symptoms in chronic pneumonia, or in other words, if the disease becomes acute for a time, the change is announced by the nature of the expectoration, which again becomes viscid, transparent, and tinged with blood.

When pneumonia supervenes on any former disease of the lung, the sputa present important anomalies. Sometimes the former expectoration disappears altogether, and is replaced by the pneumonic sputa; but frequently there is a mixture of both; and we can then draw no conclusion relative to the diagnosis, or prognosis of the disease. At other times, after the pneumonic sputa have appeared for a length of time, we have the former expectoration at the decline of the disease; and hence there is a new source of error. In cases of this kind, the white and opaque sputa have been considered as indicative of a crisis; while in truth, they were the product of an old bronchial affection, suspended or modified by the pneumonia, and re-appearing as soon as this last began to be resolved. Cases of pneumonia without expectoration are especially observed in the unfortunate and too frequent instances of severe fevers, complicated with inflammation of the lung.

In these cases, the debilitated patients, often deprived of their intellectual faculties, generally swallow the sputa, not having strength or instinct to expectorate. But it sometimes happens that the sputa are not secreted, as we may learn by asking those patients whose faculties are not disturbed, if they have any desire to expectorate; many reply in the negative.

The pneumonic sputa are evidently secreted by the bronchial membrane, sympathetically irritated by the pulmonary inflammation; according as this inflammation subsides, that of the bronchial membrane also loses its intensity, and the sputa become those of simple catarrh.

Expectoration does not take place, or the secretion of the sputa is suppressed, from the different degrees of bronchial irritation.

The prune juice sputa are connected with a peculiar inflammatory state of the bronchial membrane. In this, as in other inflamed tissues, the secretion varies according to the degree or character of the inflammation.

OF THE EXPECTORATION IN PLEURITIS.

In the acute inflammation of the pleura there is generally no expectoration, or if it appears, it is similar to that of acute catarrh. Aretæus has well established the difference between pneumonia and pleuritis, relative to expectoration. "The sputa," says he, "hardly occur in pleuritis, while they are abundant and sanguinolent in pneumonia."

When pleuritis terminates in effusion, the sputa are still those of acute or chronic catarrh; but if a communication is established between the cavity of the pleura and the bronchial tubes, the effused liquid is evacuated through the trachea, and is found in the matter of expectoration.

It has been said, that from the nature of the sputa, and the manner in which they were expectorated, we can easily recognise the existence of a pleuritic effusion, which has opened into the bronchial tubes. Let us examine how far this statement is correct. It is pretended that the purulent matter secreted in the pleura, differs altogether by its physical characters from the bronchial mucus, or the liquid secreted in phthi-

sical excavations. But these distinctions, always easy to be established in books, appear to us difficult of verification at the bedside of the patient. The extreme fœtor of the sputa, and their alliaceous odour, are set down as sure indications of their pleuritic origin. But is not the expectoration of phthisical patients often as fœtid? We have besides seen patients whose sputa were inodorous, in whom, nevertheless, a communication *did* exist between the cavity of the pleura and the bronchial tubes.

The remaining qualities of the sputa, such as their colour, consistence, and form, are all found in the expectoration of chronic catarrh. It is a generally received opinion, that when a pleuritic effusion is evacuated through the lungs, this evacuation takes place suddenly, and the patient seems as if to vomit the purulent matter. But although this may take place when a large opening is formed, it is evident that the expectoration will be gradual, in the case of a small aperture.

OF THE EXPECTORATION IN PHTHISIS.

We think, with Aretæus, that it is by the consideration of their *physical* properties that the sputa peculiar to the tubercular degeneration of the lungs can be best recognised.

At the commencement of phthisis, when some lesion of the pulmonary organs, more important than simple catarrh, is indicated by cough with frequent hæmoptysis, emaciation, and irregular febrile attacks; the sputa are yet without character.

In most individuals the cough is dry, while in others it is accompanied by a purely catarrhal expectoration, which, although remaining for a length of time, still preserves the character of that in acute catarrh. This circumstance is not to be overlooked, and should cause the physician to suspect the existence of tubercles. Nevertheless, after this dubious catarrh has remained for a long time, if the sputa are examined daily, small yellowish-white grains are observed in the expectorated matter, which have a tolerable consistence; and vary from the size of a pin's

head to that of a pea. They remain separate, and fall to the bottom of the vessel; when broken, they exhale a very fœtid odour, which has been regarded by Baglivi as pathognomic of pulmonary consumption.

We must not confound these granular bodies with those secreted by the pharyngeal glands, which are exceedingly viscid and tenacious, presenting a strong contrast to the friable tubercular debris.*

At the same period of the disease, the sputa are sometimes composed of a transparent colourless liquid, in which are suspended long and delicate striæ; in some instances floating on the surface of an opaque mucus, from which they may be distinguished by their dull white colour.

If death takes place during the first period, the lungs are found studded with small tubercles, some of which are hard, while others are beginning to soften towards their centre. It is rare, at this period, to meet with tubercles completely softened, or excavations of any size.

* A better method of distinguishing these substances is by heating them on paper. The secretion of the tonsils and neighbouring glands is sebaceous, and therefore greases the paper. This is not the case with the tubercular matter.—T.

We sometimes meet with patients who having long laboured under a dry cough, with all the other symptoms indicative of the existence of crude tubercles in the lung, suddenly expectorate a large quantity of puriform sputa, coming from a tuberculous excavation, which had opened into one of the bronchial tubes. This circumstance may prove fatal, but Bonet and Lænnec relate two cases where it took place, and yet the patients recovered their health.

According as the grains and delicate filaments which we have described, become more abundant, they unite into different-sized masses, which remain suspended in the midst of a clouded serosity; these may be then called *flocculent sputa.* In other instances they appear round and thickened, remaining perfectly separate from one another; these we have called *nummular sputa.* The appearance of these sputa is regarded by Quarin as one of the most fatal symptoms. He states that he has never seen a case terminate favourably in which they were present. When examined with the naked eye, they are seen to be formed by a multitude of little points capable of still farther subdivision. These whitish molecules are united by a semitransparent greyish

mucus, which sometimes however, is yellow or greenish, and completely opaque; so that the expectoration has a variegated appearance. At other times the sputa are composed of long, delicate striæ, sometimes twisted on themselves; and united by mucus, from which they are distinguished by their colour. But at this period the expectoration presents innumerable shades of difference, which depend, 1st, On the manner of communication of the bronchial tubes with the tubercular excavation; 2d, On the number, length, size, and mode of division of the bronchial tubes, through which the matter must pass before coming to the trachea; 3d, On the quantity and nature of the mucus with which it is mixed; and 4th, On the length of time it has remained in the bronchial tubes before its expulsion.

In whatever manner these varieties are formed, we obtain a correct idea of them from the name of *compound sputa*, first given by M. Lerminier. When a patient dies, who presented the above expectoration, we are sure to find the tubercles in a complete state of softening, with deep excavations already formed in the pulmonary tissue.

During the latter periods of the disease, there

is secreted from the sides of the tuberculous excavations a liquid of a dirty ash-grey, sometimes reddish colour, which last tinge appears to arise from the mixture of a certain quantity of blood. This liquid, which has a great analogy to the sanious pus of old and ill-conditioned ulcers, is frequently mixed with small grains of decomposed tuberculous matter.

When the excavations are found containing the above fluid, it is generally the case that its existence was revealed by the characters of the expectoration; in which latter, this liquid occurs at first in small quantity, but gradually increasing, at length almost entirely constitutes it. It is then nearly a homogeneous pus, sometimes fœtid, sometimes inodorous, and containing grains of softened tuberculous matter scattered through it. These latter, however, do not always occur; and we have seen cases, where, although found in the excavations, they did not appear in the sputa.

In the latter periods of the disease, when the sputa do not take on the puriform aspect, but still continue divided, it frequently happens that twenty-four or forty-eight hours before death, the character of the expectoration is altogether chang-

ed, the serosity disappears, and the sputa form a thick greyish mass, strongly adherent to the bottom of the vessel.

In other cases, expectoration is altogether suppressed a short time before death; the symptoms are then aggravated, and the strength rapidly diminishes. This sudden suppression may be justly looked upon as one of the most fatal symptoms. As in pneumonia, it may arise from two causes: first, From the inability of the patient to expectorate, the sputa collect in the larynx and trachea, and he sinks in a state of asphyxia. In the second case, the expectoration is suddenly suppressed, without any tracheal rale being heard while at the same time the mucous rale, which indicates the existence of a cavity filled with liquid under the point where it occurs, suddenly ceases to be heard in this situation, although a short time before it had been completely evident. We must then admit, that the liquid filling the cavity was rapidly absorbed.* In some cases, where the patients ceased to expectorate immediately before death, we have found vast excavations entirely empty.

* May not the phenomenon be explained, by supposing that the softened tuberculous matter had passed into and filled the

The attention of physicians has been for a long time directed to the odour of phthisical sputa, which, in most patients have a faint and nauseous smell. In these individuals the disease may go through its different stages, and death supervene, without the odour of the sputa becoming more disagreeable. In other cases, the expectoration, although long inodorous, will, a few days before death, acquire an insupportable fœtor, which is also perceived in the matter of the cavities.

What is the cause of this change of odour? The fœtor of pus, which often arises from its contact with air, may in some cases depend on other circumstances; such as its own qualities, and the time it has remained in the cavity. The same should be true of the liquid contained in tuberculous excavations of the lung.

But observation has shown, that from whatever cause the fœtor may arise, it is one of the most fatal symptoms, when occurring in a patient whose expectoration was previously inodorous.

The fœtor of expectoration, at the commencement of the disease, is a far less unfavourable

smaller bronchial tubes, from whence, owing to the great debility of the patient, it could not be expectorated?—T.

symptom; as patients thus affected have lived for a length of time.

The taste of the sputa, as perceived by the patient, has attracted as much attention as their odour. Most authors have advanced, that those patients whose sputa are insipid, sink less rapidly into a state of marasmus. But our experience does not confirm the truth of this position. We have seen many phthisical patients who complained of the insupportable taste of their expectoration, and who nevertheless sunk but slowly. Others, on the contrary, died rapidly, although their sputa were nearly insipid. We have met with few patients whose expectoration had the mild and saccharine taste described by Hippocrates, as one of the symptoms of pulmonary consumption. Sputa possessed of a saline taste, have been also noticed by Hippocrates as one of the precursory signs of phthisis. Morton insists much on this symptom; but we see many patients labouring under a simple catarrh, whose sputa have a saline taste, and yet these individuals may never become phthisical; and, on the other hand, there are many consumptive patients, whose sputa never have a well-marked saline taste.

It must be left to future experience to decide,

whether the expectoration of phthisical patients can ever be so acrid, as to erode the parts with which it may come in contact.

Hitherto we have described the expectoration in phthisis, as it occurs in the majority of cases. But we have seen several instances where this disease went through all its stages, where, even after death, large excavations were found in the lung; and in which notwithstanding, the expectoration furnished no diagnostic sign whatever. In support of this singular fact, I shall quote the following cases:

1. A young woman, labouring under violent cough and dyspnœa, remained for three weeks in the hospital, with evident pectoriloquism in the antero-superior part of the right side of the chest. Her expectoration, however, was all through purely catarrhal, and composed of a colourless, transparent, and thready mucus, adherent to the edges of the vessel by long striæ, some of which were opaque. After death, large excavations were found in the right lung, half filled with an ash-coloured liquid, through which there floated small grains of a dull white colour. Both lungs were studded with tubercles, most of which were still crude.

2. A young man, presenting every symptom of

phthisis in its last degree, with pectoriloquism, at the sub-spinous fossa, had habitually but a trifling expectoration, similar to that of acute catarrh arrived at its last period. It was composed of a greenish yellow, thready, homogeneous mucus, mixed with air and saliva. During the six weeks that he remained in the hospital, his expectoration was mixed with striæ of a dirty reddish colour, which appeared to be derived from pulmonary excavations. Upon dissection, we found the right lung entirely studded with miliary tubercles, of which some were also seen in the left pulmonary organ. At the superior part of the right, was a cavity capable of containing a large walnut, and completely empty.

3. Upon opening the body of a woman, who had sunk under a chronic diarrhœa, we found at the superior part of both lungs several small cavities, which communicated with one another, and were filled with softened tuberculous matter. Into one of these a large bronchial tube opened. But it is extraordinary, that during this woman's stay of three weeks in the hospital, she never expectorated at all, nor complained of any morbid symptom in the side of her chest.

4. A young man sunk under peritonitis, which supervened on a chronic enteritis. He stated that he never coughed, and the expectoration was wanting. After death an empty cavity, capable of containing an apple, and lined by a thin concrete purulent matter, was found at the top of the right lung. Several smaller excavations, communicating with one another, and equally empty, were found on the same side. The rest of the lung contained many crude tubercles.*

In this case, did the excavations, once emptied of their tuberculous matter, cease to produce any new secretion? Was the secretion in the lung suspended by the abdominal affection?

In some instances, we have found large excavations, filled with a grey or reddish liquid, which was not observed in the sputa, although they indicated clearly the existence of phthisis.

When pneumonia supervenes on phthisis, the sputa change their character altogether, and only

* Of the preceding cases, the third only appears to me to prove the extraordinary proposition in question. In the others, the excavations were found empty; and the expectoration in the two first, had the tubercular character in some degree, see page 212; these cases were also too short a time under observation, to warrant the drawing of any general conclusion.—T.

show acute inflammation of the lung; except in some cases, where the two expectorations are blended.

In order that we shall not be led into error by the characters in phthisical sputa, it is necessary to pay attention to the particular hour at which they are examined. Many patients have a characteristic expectoration during the night and morning only, and for the rest of the day they do not expectorate, or if they do, their sputa are purely catarrhal. Others only expectorate at the close of the hectic exacerbations, while during the paroxysm, their cough remains dry.

Tuberculous excavations are thus analogous to many external ulcers, whose surfaces become dry during the access of an intermittent, and again moist at the close of the paroxysm.

It sometimes happens, that at intervals, the sputa cease to be characteristic, without our being able to assign any cause for this change. This intermittence of expectoration, we have frequently seen to alternate with diarrhœa; when the stools become very frequent, the sputa were either less abundant, or ceased altogether. We have also seen a case of a phthisical patient who had caries of one of the left ribs, in whom the expectoration

diminished whenever the suppuration increased, and *vice versa.*

EXPECTORATION IN EMPHYSEMA OF THE LUNG.

Emphysema of the lung is generally accompanied by the symptoms of catarrh, and the expectoration is therefore very variable in its character; the cough is sometimes dry, sometimes followed by the expulsion of a greyish, transparent, and more or less viscid fluid. At other times the sputa are thick and opaque.

EXPECTORATION IN ŒDEMA OF THE LUNG.

In this case, the expectoration, according to M. Lænnec, is aqueous and transparent, like that of acute catarrh. But as œdema of the lung is rarely a primitive disease, and may occur in many different diseases where the bronchial mem-

brane is already affected, such as chronic catarrh, pneumonia passing into resolution, diseases of the heart, fevers, &c.; it seems probable, that the expectoration in this disease may appear under many different aspects; and such, indeed, has been the result of our experience.*

* For the description of the expectoration in gangrene of the lung, I refer the reader to the cases of this affection related in the first part of the appendix.

In the preceding translation, I have omitted the characters of expectorated matter, as drawn from the use of chemical tests. These characters, though given at length by M. Andral, I conceive not determined as yet with sufficient accuracy, and such is the opinion of the above author. I therefore resolved on not inserting them in this work, the object of which is to combine brevity and truth.—T.

FINIS.

PRINTED BY A. BALFOUR AND CO.

INDEX.